



























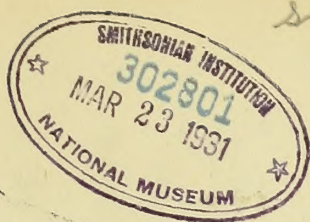






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 De Lestang, Albert, Adel's Grove, via Burketown, North Queensland.  
 Dix, Edward Victor, Glynde Road, Firlie, South Australia.  
 Dodd, Alan P., Prickly Pear Laboratory, Sherwood, Queensland.  
 Drier, Dr. Eric Newton, Vancouver, Canada.  
 Dunphy, Miss C., 4 Moran Court, Sophia Street, Bondi.  
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 Ellis, F., 268 Holden Street, Canterbury.  
 Emerson, Robert, 12 Oakville Street, Willoughby.  
 Enright, W. J., West Maitland.  
 Falkiner, Mrs. Otway, Widgeiwa.  
 Ferguson, Mrs. C. A., "Glen Fergus," Cooma.  
 Ferguson, Thomas L., "Rancliff," Ocean Street, Woollahra.  
 Ferry, M., 39 Northcote Street, Naremburn.  
 Finlayson, Hedley Herbert, 305 Ward Street, North Adelaide, South Australia.  
 Fleming, James, 507 George Street, Sydney.  
 Fletcher, H. O., Australian Museum, Sydney.  
 Francis, Grosvenor A., Canberra, F.C.T.  
 Fraser, Dr. Elizabeth A., Zoology Dept., University College, Gower St., London.  
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 Gostelow, E. E., Consett Street, Concord West.  
 Gray, Miss Elsie, "Norwood," Kirribilli Avenue, Kirribilli.  
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 Gwynne, A., 112 Silver Street, Marrickville.  
 Hamilton, A. G., Hercules Street, Chatswood.  
 Hargreaves, E., 9 Addington Avenue, Ryde.  
 Hargreaves, J., 9 Addington Avenue, Ryde.  
 Hardy, G. H., The University, Brisbane, Queensland.  
 Harnett, Miss Eileen, "Casuarina," Cronulla.  
 Hollingsworth, W. S., 9 Saville Street, Gore Hill.  
 Horton-Smith, Clifford, Syddal Park, Bramhall, Cheshire, England.  
 Houston, J. K. S., 274 Church Street, Parramatta.  
 Hubbard, Rev. Percy, The Rectory, Innisfail, Queensland.  
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 James, Leslie, 33 Henson Street, Summer Hill.  
 Johnson, Dr. Alan Syme, Lister House, St. George's Terrace, Perth, W.A.  
 Johnston, R. A., Engineer's Branch, Sydney Harbour Trust.  
 Johnston, Worsley Clifton, Riverton, South Australia.  
 Jones, E. W., 8 Culwulla Street, Hurstville.  
 Jones, J. T., Mountain Road, Austinmer.  
 Kater, Mrs. H. E., "Headingley," Wellington Street, Woollahra.  
 Kemp, Arthur Perry, Boonanghi, Quirindi.  
 Kinghorn, Mrs. J. R., 8 Arabella Street, Northwood.  
 Laneck, H. D., 195 Lane Cove Road, Artarmon.  
 Laws, Charles R., Teachers' Training College, Dunedin, New Zealand.  
 Le Souef, Cecil, "Taronga," Sverge Street, Mosman.  
 Livingstone, Arthur A., Australian Museum, Sydney.  
 Longman, Heber A., Queensland Museum, Brisbane, Queensland.  
 Lowe, Mrs. Norman E., 56 Bradley's Head Road, Mosman.  
 Lyons, H., 86 Bayview Avenue, Undercliffe.  
 Mann, John S., Prickly Pear Board, Chinchilla, Queensland.  
 Manners, A., 5 Station Street, Tempe.  
 Manners, Robert, "Taree," 532 Unwin's Bridge Road, Tempe.



- MacDougall, William Alexander, Gordonvale, Queensland.  
 Mackay, Dr. John S., 4 Fawkner Street, South Yarra, Victoria.  
 Mackie, J. S., 160 Denison Road, Dulwich Hill.  
 Mackerras, Dr. Ian M., Canberra, F.C.T.  
 McCarthy, T., Box 36A., G.P.O., Sydney.  
 McClelland, Hugh, End House, The Square, Solihull, Warwickshire, England.  
 MacPherson, Dr. John, "Wyoming," 175 Macquarie Street, Sydney.  
 McNeill, F. A., Australian Museum, Sydney.  
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 Martin, V., 214 Barker Street, Randwick.  
 May, B. W., 39 Denison Street, Arncliffe.  
 Mayer, Frederick W. S., c/o R. P. Mayer, 88 Concord Road, Homebush.  
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 Middleton, Miss D., 479 Alfred Street, North Sydney.  
 Moody, Beresford R., "Cooiana," Lane Cove Road, Wahroonga.  
 Mort, Harold S., B.Sc., B.E., 13 Milner Street, Mosman.  
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 Nubling, Erwin, 38 Macleay Street, Sydney.  
 Oliver, Arthur W. L., Custom House, Shanghai, China.  
 Oliver, W. R. Brooks, Dominion Museum, Wellington, New Zealand.  
 Packer, G. F., 44 Croydon Avenue, Croydon.  
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 Peir, H. E., 110 Bathurst Street, Sydney.  
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 Perry, Alan A., Bellevue Hill, Portland.  
 Phillipps, William John, Dominion Museum, Wellington, New Zealand.  
 Powell, A. W. B., 65 Shortland Street, Auckland, New Zealand.  
 Power, J. H., School of Mines, 15 Hull Street, Kimberley, South Africa.  
 Probsthain, Arthur, 4 Great Russell Street, London, W.C.1.  
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 Ross, C. S., Harnett Street, Marrickville.  
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 Seaward, William Trotman, "Myala," Scone.  
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 Serventy, D. L., 36 Onslow Road, Subiaco, Western Australia.  
 Sheridan, Miss Helen, 36 Stuart Street, Longueville.  
 Simmonds, J. H., Hillsdon Road, Taringa, Brisbane, Queensland.  
 Smith, Miss Gladys, Clifton Hall, Ocean Beach, Manly.  
 Smith, Mrs. Grafton, "Munni," Dungog.  
 Smith, Miss Vera Irwin, "Coree," Wisdom Road, Greenwich.  
 Smith, Norman M., 4a Wyatt Avenue, Burwood.  
 Spence, Dr. K. K., 51 Sophia Street, Bondi.  
 Springall, C. W., 478 Mowbray Road W., Lane Cove.  
 Stanger, H. K., 56 Young Street, Neutral Bay.  
 Steeles, C. E., 70 Bayview Street, Undercliffe.  
 Sundstrom, Henry Gustav, "Brynmay," 74 Alt Street, Ashfield.  
 Swain, Miss E. M., Department of Labour and Industry, Sydney.  
 Tancred, P. H., Hardy Street, South Ashfield.  
 Thompson, Dr. R. W., Chapel Road, Bankstown.  
 Thomson, C. V., "Trevallyn," Cocos Avenue, Eastwood.  
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 Turner, Dr. A. Jefferis, Wickham Terrace, Brisbane, Queensland.  
 Walton, Charles, Wooldridge Street, Peterhead, South Australia.  
 Ward, J. E., 10 Ewinton Street, Balmain East.  
 Weeding, Rev. Benjamin J., Methodist Manse, Moonta Mines, S.A.  
 White, James, Forest Road, Peakhurst.  
 White, Richard, 15 Salisbury Road, Kensington.  
 Whiteley, A., 17 East Crescent, Hurstville.  
 Wilkes, A. J., Illawarra Street, Kogarah.  
 Williams, Amos E., Bullembalong Road, Berridale, via Cooma.  
 Williams, George Richard, 34 Rowes Street, Eastwood.  
 Wilson, F. Erasmus, Ferncroft Avenue, East Malvern, Victoria.  
 Wise, Miss Mary I., Foster Street, Sale, Victoria.  
 Witheford, Charles Exley, 389 North Street, Albury.  
 Worth, G., 74 Princes Highway, Arncliffe.  
 Wright, John Herbert, Australian Museum, Sydney.

# THE AUSTRALIAN ZOOLOGIST

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Issued by the  
Royal Zoological Society of New South Wales

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Edited by  
A. F. BASSET HULL, C.F.A.O.U.

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# Royal Zoological Society of New South Wales.

Established 1879.

REGISTERED UNDER THE COMPANIES ACT, 1899 (1917).

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# Royal Zoological Society of New South Wales.

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## THE ANNUAL MEETING.

The fiftieth annual meeting of the Society was held in the Union Refectory, University of Sydney, on Wednesday, 24th July, 1929, at 8 p.m., fifty members and visitors being present. The visitors included the Hons. D. H. Drummond (Minister for Education), representing the Government; R. T. Ball (Minister for Lands), and E. H. Farrar (Minister for Labour and Industry). The honorary secretary read the

## FIFTIETH ANNUAL REPORT.

On 30th June, 1929, there were 453 members on the Register, divided into the various categories as follows: Associate benefactors 3, life members 30, ordinary members 265, life associate members 23, associate members 122, honorary members 6, honorary associate members 4. Six members died during the year, fifteen resigned, the names of ten members were removed from the Register, and 48 new members were elected, giving a net increase of 18 members for the year.

### *The Council.*

A vacancy in the Council occurring through the resignation of Mr. R. C. Dixon, in June, 1929, was filled by the election of Professor W. J. Dakin. Eleven meetings of Council were held during the year, at which the attendances were: Mr. Hull 11, Messrs. Bryce and Troughton 10, Drs. D'Ombraïn and Waterhouse, Messrs. Cayley, Kinghorn and Musgrave 9, Messrs. Froggatt and Roughley 8, Messrs. Chisholm and Halloran 7, Dr. Nicholson and Mr. Stead 6, Mr. Dixon 5, Mr. Coles 4, and Mr. Pollock 3. The two latter councillors were granted leave of absence for the greater part of the year.

### *Sections.*

The attendance at the meetings of the sections has been steadily maintained, and in the near future steps must be taken to secure the use of a larger room, as our present seating accommodation, limited to 35, is frequently insufficient.

### *The Australian Zoologist.*

Parts 3 and 4, completing volume 5, were issued during the year, and the Society was again enabled to present two plates in colour.



*Finances.*

The funds now stand higher than ever before, the Jubilee Commemoration appeal being responsible for the substantial increase. It will be noted that the Government grant of £50, which was paid from 1922 to 1926, has not appeared in the balance sheet for this or the previous year, the Department on whose estimates the grant is voted annually being of opinion that the Society is financially able to function without a Government subsidy.

*The Society's Jubilee.*

On 23rd March, 1929, a function was held at Taronga Zoological Park, to celebrate the completion of the fiftieth year of the Society's existence. A number of representative citizens were invited to meet the Council and members at afternoon tea, and the Hons. D. H. Drummond and R. T. Ball, Ministers for Education and Lands respectively, represented the Government, the former delivering a short address to those present. The President outlined the work of the Society, and appealed for funds to enable the production of Australian Zoological Handbooks for the use of the higher schools and the younger students of natural history. The response to this appeal has been fairly encouraging, but owing to the many other appeals launched about the same time the Society has not pressed its claims, but is content to wait until a more favourable period. In the meantime its work of preparing the manuscript of the Handbooks is being pushed on.

The following contributions to the Handbook Publication Fund have been received:—

Miss E. Hume-Barbour, £106; Albert Littlejohn, £100; A. A. Lawson, £50; Robert C. Dixon, £25; Walter and Eliza Hall Trust, £20; J. R. Wallace and Aubrey Halloran, £5/5/- each; H. J. Cantor, £5; G. H. Wyld, £3/3/-; P. Shipway, E. J. Loxton, R. A. Marks, W. C. Cormack, L. Ennis, E. J. Bryce, Miss V. A. Bartlett, Dr. C. Anderson, A. S. Le Souef, £2/2/- each; B. R. Gelling, £2; W. H. Barkley, A. E. Williams, and J. R. Kinghorn, £1/1/- each; H. G. Kilby, £1; small amounts, 15/-; total, £345/9/-. Mrs. C. T. Newman has contributed £5/5/- to capital account.

At the suggestion of Miss Hume-Barbour, a Women's Auxiliary has been formed to raise funds for the publication of Handbooks. His Excellency the Governor General, Lord Stonehaven, and Lady Stonehaven have accorded their patronage, and the officers are: President, Mrs. Norman Lowe; vice-presidents, Lady Poynter, Miss Hume-Barbour, Mrs. Walker Jones, and Mrs. Price Conigrave; honorary secretary and organiser, Mrs. Emily Bennett; honorary treasurer, Mrs. Edmond Gates. It is desired that ladies willing to act on the committee or to assist in the work of the auxiliary should communicate with Mrs. Bennett, Box 2399 M.M., G.P.O., Sydney.

*Honorary Auditor.*

By the death of Mr. E. E. Coates the Society has lost a valued honorary officer who had acted as auditor, not only ever since the incorporation of the Society in 1917, but for some years previously in the old Moore Park days. The vacancy has been filled by the election of Mr. R. J. Stiffe, of the firm of Coates, Cunningham & Co., who has kindly consented to take over the office so ably filled by his late partner.

*Associate Benefactors.*

For their valuable services to the Society in connection with the Jubilee Commemoration Fund, Miss Emily Hume-Barbour and Mr. Albert Littlejohn were elected associate benefactors.

*Taronga Park Trust.*

By the death of the Hon. Frederick Flowers, M.L.C., late chairman of the Taronga Park Trust, the Society has lost a former member of Council, who represented the Government prior to the Society's incorporation. Although he did not continue a member, he was always interested in the Society's progress, and did much to maintain cordial relations between it and the Trust. The vacancy on the Trust was filled, as already announced, by the appointment of Mr. Aubrey Halloran, a member of Council of the Society. Colonel Alfred Spain, now chairman of the Trust, Mr. P. B. Colquhoun, Dr. R. H. Todd, and Mr. A. F. Basset Hull, other members of the Trust, are also members of the Society.

*Balance Sheet.*

The honorary treasurer, Mr. Phillip Shipway, moved the adoption of the report and balance sheet. The motion was seconded by Colonel Alfred Spain, and carried.

The six retiring members of Council, Messrs. Neville W. Cayley, A. Halloran, A. F. Basset Hull, David G. Stead, E. L. Troughton, and Professor W. J. Dakin, were re-elected.

The president then read his address (see page 6).

*New Members.*

The following new members have been elected since the publication of the last list (March 24, 1929):—

Ordinary Members.—F. S. L. Catchlove, A. den Hertog, Miss C. Gregory, R. T. Hunt, P. Hyams, Mrs. P. Hyams, T. Iredale, P. W. Lovett, W. H. Llewellyn, T. F. Massie, J. A. R. Patrick, K. J. Patrick, A. J. Pronk, Mrs. B. Sims, A. Sverjensky, J. D. C. Tanner, J. L. Wassell, and J. H. Yates.

Associate Members.—S. L. Allman, Miss E. Butters, A. E. Brown, D. L. Comtesse, T. L. Ferguson, G. Grimm, L. L. Jones, C. R. Laws, A. J. Marshal, Dr. J. S. Mackay, and Miss M. Whalley.

Honorary Associate Member.—Archibald J. Campbell.

*Officers.*

At a meeting of Council, held on July 31, the following officers were elected for the year ending June 30, 1930:—

President.—Anthony Musgrave, F.E.S.

Vice-Presidents.—Aubrey Halloran, B.A., LL.B., J. R. Kinghorn, C.M.Z.S., A. J. Nicholson, D.Sc., and G. A. Waterhouse, D.Sc.

Honorary Secretary and Editor.—A. F. Basset Hull, C.F.A.O.U.

Assistant Honorary Secretary.—E. J. Bryce, F.R.G.S.

Honorary Treasurer.—Phillip Shipway.

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# ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES

BALANCE SHEET AS AT 30th JUNE, 1929.

LIABILITIES.			ASSETS.		
	£	s. d.		£	s. d.
General Capital Account .. ..	791	5 0	General Capital Account—		
General Income Account .. ..	98	3 3	Commonwealth In-		
Hand Book Fund Capital Ac-			scribed Stock		
count .. .. .	505	7 6	(f.v. £650) .. ..	641	5 0
Hand Book Fund Income Ac-			N.S.W. Govern-		
count .. .. .	34	9 4	ment Funded		
			Stock (f.v. £50)	50	0 0
			N.S.W. Govern-		
			ment Debentures		
			(f.v. £100) .. ..	100	0 0
				791	5 0
			General Income Account—		
			Commercial Bank-		
			ing Company of		
			Sydney, Ltd. ..	25	7 10
			N.S.W. Govt. Sav-		
			ings Bank .. ..	72	15 5
				98	3 3
			Hand Book Fund Capital Account—		
			Commonwealth		
			Treasury Bonds		
			(f.v. £500) .. ..	505	7 6
			Including—		
			Albert Littlejohn		
			Endowment .. ..	100	0 0
			Miss E. Hume Bar-		
			bour Endowment	106	0 0
			Walter & Eliza Hall		
			Trust Endowment	140	0 0
			Hand Book Fund Income Account—		
			N.S.W. Government		
			Savings Bank ..	34	9 4
				£1,429	5 1
	£1,429	5 1			

## HAND BOOK FUND INCOME ACCOUNT.

RECEIPTS.			DISBURSEMENTS.		
	£	s. d.		£	s. d.
To Balance at 30th June, 1928	62	4 1	By Printing .. .. .	16	10 0
„ Donations .. ..	1	1 0	„ Investments .. .. .	505	7 6
„ Donations per			„ Balance 30th June, 1929,		
Jubilee Appeal—			N.S.W. Government Savings		
Albert Little-			Bank .. .. .	34	9 4
john, Esq. ..	100	0 0			
Miss E. Hume					
Barbour .. ..	106	0 0			
Walter and Eliza					
Hall Trust ..	20	0 0			
Amts. under £20	47	12 0			
		273 12 0			
„ Hand Book Sales—					
„ “Loricates” .. ..	3	0 3			
„ “Fishes” .. .. .	2	1 6			
		5 1 9			
„ Repayment of					
Investments ..	188	5 0			
„ Interest on In-					
vestments .. .	26	3 0			
	£556	6 10		£556	6 10



### GENERAL INCOME ACCOUNT.

RECEIPTS.		DISBURSEMENTS.	
	£ s. d.		£ s. d.
To Balance 30th		By Publication of "Australian Zoologist"	
June, 1928 . . . .	70 5 8	(Vol. 5, Pts. 3 & 4.)	
" Subscriptions—		" Printing . . . . .	191 4 0
Ordinary, Life . . . .	21 0 0	" Blocks . . . . .	60 17 9
" Annual . . . . .	278 18 6	" Postage and De-	
Associate, Life . . . .	11 5 0	livery . . . . .	13 13 9
" Annual . . . . .	44 15 1		265 15 6
	355 18 7	By Office Rent . . . . .	93 6 8
" Donations . . . . .	2 2 0	" Office Printing . . . . .	19 4 6
" Donations "Gundamaian"		" Office Furniture . . . . .	7 10 0
Cottage Expenses . . . . .	8 3 0	" "Gundamaian" Cottage Boat	4 0 0
" Sales "Australian Zoologist"	1 11 0	" Export of Oysters to Hono-	
" Sales Reprints from "Aus-		lulu, F. & A. Department . .	1 19 0
tralian Zoologist" . . . . .	15 3 9	" Exchange and Bank Fees . .	1 12 2
" Annual Dinner (1927) Re-		" Jubilee Commemoration Tar-	
ceipts . . . . .	0 7 0	onga Park . . . . .	4 0 0
" Rent of Office . . . . .	26 1 5	" Telephone charges and	
" Payment from C.S. & I.R.		G.P.O. Box Fee . . . . .	7 10 0
towards Phone expenses . .	3 5 0	" Petty Cash—	
" Sale Lantern Sheet . . . .	1 0 0	Office Stationery . . . . .	2 4 8
" Interest on Investments . .	50 18 4	Electric Light	
" Prepaid Bank Exchange . .	0 16 4	Charges . . . . .	0 8 11
" Refund Expenses re export-		Jubilee Celebration	
ing Oysters to Honolulu,		. . . . .	9 1 5
F. & A. Department . . . .	1 19 0	Sectional Ex-	
" Miscellaneous Receipts . . .	0 10 0	penses . . . . .	3 11 8
		Postages, etc. . . . .	19 13 4
			35 0 0
		By Balance 30th June, 1929—	
		" Commercial	
		Banking Com-	
		pany of Syd-	
		ney, Ltd. . . . .	25 7 10
		" N.S.W. Govern-	
		ment Savings	
		Bank . . . . .	72 15 5
			98 3 3
			£538 1 1
	£538 1 1		

Audited and found correct.

(Signed) ROBT. J. STIFFE, A.C.A. (Aust.)..

Hon. Auditor.

Sydney, 16th July, 1929.

(Signed) PHILLIP SHIPWAY.

Hon. Treasurer.

## OUR NATIVE FAUNA—A WASTED ASSET.

By A. F. BASSET HULL.

Nature took millions of years in evolving the unique fauna of Australia, and for other millions of years it has remained at that stage of development at which Nature left it, while she passed on to other lands to evolve other and distinctive faunas. Now that element of ruthless destruction, man, is doing his best to exterminate Nature's work in a couple of centuries, and our Australian Governments do but little to check this extermination.

Our native fauna may be considered from three viewpoints: (a) The scientific, (b) the aesthetic, and (c) the economic viewpoint.

*The Scientific Viewpoint.*

From this viewpoint we must regard the whole fauna, from the humblest invertebrate to the highest marsupial mammals. The Australian forms, especially in the higher groups, include an overwhelming majority peculiar to this island continent, and therefore most interesting to the scientist. The numerous expeditions sent to Australia by British, American, Swedish, Danish, and other foreign nations, not only in the early days after discovery, but up to the present year, evidence the keen interest taken in our fauna. Captain (now Sir Hubert) Wilkins made his way into the wilds of Australia, collecting specimens of animals and birds for the British Museum. The American Museum of Natural History sent Mr. Raven to collect specimens of the rarer marsupials to fill gaps in its collection, and these two are but recent examples of a stream of scientists who have penetrated the forests and plains of Australia to obtain examples of our unique birds and animals before it is too late! Sir Colin Mackenzie, who presented his collection of marsupials and anatomical specimens to the Commonwealth Government quotes Professor Ritter, the American psychologist, who says: "The commencement of the study of human psychology must be made in the Australian animal, where we can study the genesis of conduct and intelligence." On this Sir Colin comments as follows: "The human brain consists of two halves, and so that they shall work in unison there is a broad connecting band called the callosum between them. By means of this band the two brains are enabled to function as one. The problem of co-ordination in nervous diseases is a most difficult one to understand, but the clue is found in our marsupials, where the two sides of the brain work without this band. And so we ask: If it is not necessary in an intelligent animal like the kangaroo, why is it necessary in us?"

Examples of the value of our fauna from the scientific viewpoint might be multiplied until this address assumed the dimensions of an encyclopaedia, but I think enough has been said to illustrate the first of the three viewpoints.

The protective laws are sometimes rather curiously administered when specimens are required for strictly scientific purposes. Permits to collect are issued with too strict a regard for economy. Mr. H. C. Raven, who was collecting for the American Museum of Natural History, quotes statistics, showing that opossums and kangaroos were trapped in hundreds of thousands in Tasmania during the open season, but when he applied for permission to take some specimens for his museum "the presence of a foreign scientific collector in their midst seemed to arouse the Tasmanian authorities to the defence of their native fauna to such an extent that the police regulations against collecting were, for once at least, rigidly enforced. Finally, however, I was permitted to collect for the scientific and educational purposes of the American Museum of Natural History, *ten each* of the marsupials."

Similar restrictions are imposed in other States, and a permit to collect a few specimens of the Barrier Reef birds and their eggs was refused to a scientific party, although it is known that the beche-de-mer fishermen take toll in thousands of the eggs and young of the terns which breed on the sand cays and islets of that region. Of course, in the one case the collector is virtually under observation, while in the other he is not. What the eye does not see, the official heart does not grieve at!

#### *The Aesthetic Viewpoint.*

Here we are reduced to the consideration of the beautiful, remarkable, or otherwise obviously interesting of our fauna, such as the birds and animals that can and do add to the attractiveness of any landscape, or afford pleasure to the observer or lover of the open air and the beauties of Nature. From this point of view the scientific and economic factors do not count, and therefore the beautiful but mischievous cockatoo claims as much consideration as the quaint and harmless lyre bird; the savage Tasmanian devil attracts as much attention as the silky flying squirrel; the destructive pelican evokes as much interest as the elegant and useful silver gull. To protect and encourage these objects of beauty and interest should be part of any national policy. The example of America and Canada, and more recently Africa, in setting apart huge reservations where the almost extinct bison, elk, and other animals in danger of extermination by the big game hunter may be allowed a chance to live and multiply should be more closely followed in Australia. True, there are national parks, sanctuaries, reserves for the preservation of game, in practically all the States, but the actual preservation of any bird or animal that offers a good feed or a saleable pelt is a matter of extreme difficulty. One reason is that there is insufficient policing of the reserves, some of which are large enough to require a battalion of rangers to keep their animal contents adequately protected, and another reason is the absurdly small fines inflicted or other punishment meted out to offenders who are caught.

I have every confidence in the recuperative powers of our Australian fauna, flora, and finance, provided that the avoidable factor of waste is eliminated. Let me quote from an article by Dr. MacGillivray, of Broken Hill, on birds in central Queensland (*Emu*, xxix, 1929, 67): "Tambo was passed through on a Sunday afternoon. It is remarkable, chiefly for the number of bottle trees grown for ornamental purposes, and for its lagoon or lake formed by surplus bore water. This was alive with water fowl and presented a fine sight. It speaks volumes for the beneficent results of protection. Maned geese, grey duck, grey teal, tree ducks, pink-eared ducks and white-eyed ducks were recognised in large flocks. Other birds noted were coots, white-headed stilts, yellow-billed spoonbills, and other waders, including dotterels."

In many parts of New South Wales a season or two of protection almost invariably results in the rapid increase of opossums and kangaroos, so much so that one often sees paragraphs in the daily papers such as: "Kangaroos roam in thousands. Menace to stock in Nevertire district. Motor-ing over 100 miles from Nevertire district, a large deputation of graziers waited on Mr. Akhurst, M.L.C., at Dubbo, urging him to make representations for an open season for kangaroos in Nevertire district. The marsupials have eaten out all feed there. Mobs of 500 have been seen, and one member of the deputation guaranteed to show Mr. Akhurst 1,000 in a five square miles area. The whole bush, he said, seemed to be moving with them." (*"Daily Telegraph Pictorial,"* Sydney, 8th July, 1929). If the representations of the graziers are favourably entertained and an open season



proclaimed for the district, a battue will naturally follow, and thousands of animals will be slaughtered and wasted.

The example of America might again be referred to. In the early days of settlement the bison was wastefully slaughtered until it was virtually exterminated. A few survivors were collected and rigorously protected, so that now fine herds roam in the National Parks. Among the birds the passenger pigeon, which was once so numerous that the flocks literally darkened the sky as they passed over, was so wastefully shot down that it was actually exterminated, and no specimen has been seen in the United States for many years. The beautiful herons, from which the "osprey" plumes were taken in the breeding season, were almost exterminated, while terns, gulls and other birds yielding marketable plumage were so harried by hunters that they almost disappeared from the great Florida swamps. Now let me quote Alfred M. Bailey, in "Natural History" for June, 1929: "The coastal marshes of Louisiana are renowned as the wintering grounds of our northern breeding birds; hordes of ducks and geese wing their way from tundra lakes and arctic shores to the low lands bordering the Gulf of Mexico and seek refuge on the wide-stretching savannahs. Many wild life reservations have been set aside in Louisiana, and ducks and geese of many species find food and safety within their borders. The abundance of bird life along the coast is a lasting monument to bird conservation and to the men who caused legislation to be enacted for the preservation of our wild life. For it was not many years ago that feather hunting was at its height; there was a great demand for the plumes of the egret and the wings of the tern. Boatload after boatload of hunters left the small settlements and scoured the shores for birds. They visited the heronries and shot the egrets as they were returning with food to their young, and they raided the colonies of the nesting terns and gulls, killing the birds by thousands. The dull boom of black powder could be heard from all sides, and the slaughter continued as long as a target was found. The result was inevitable; the birds were practically exterminated. And then came legislation to prohibit the killing of birds for millinery purposes, and President Roosevelt set aside many small islands as breeding sanctuaries. For a few years it seemed the conservationists were too late, but gradually colonies were formed, the birds were allowed to breed in safety, and now, after twenty years of protection by the Federal and State Governments, Louisiana has a wealth of bird life unequalled by any other State."

#### *The Economic Viewpoint.*

The value of our fauna from the purely commercial point of view cannot be accurately estimated in pounds sterling, owing to the absence of statistics as to the local consumption, but the export value exceeds one million pounds per annum in furred skins alone. (This, of course, excludes rabbit skins, the export value of which exceeds £2,000,000 per annum). If to the furred skins the value of birds, shell (pearl and trochus), beche-de-mer, and other faunal products were added, the export value would probably exceed £1,500,000 per annum. This is in spite of the wasteful manner in which the bulk of our natural product is harvested.

If the taking of all classes of natural products were regulated the value would certainly be increased owing to the added quality resulting from the adoption of less wasteful methods.

Each State of the Commonwealth has legislated, during the past thirty years or more, ostensibly to afford some measure of protection to the native animals and birds having commercial value, and during more recent times such legislation has been extended to birds having economic value as insect destroyers. Each State, however, has different views as to the species to be

protected, the extent of protection to be afforded, and the administrative methods to be adopted to enforce observance of its laws. So far as the isolated State of Tasmania is concerned these differences have no effect on the fauna; but the mainland States with their artificial boundaries and without any physical barriers, such as Bass Strait, observe no uniformity in their laws, so that an animal protected in one may be unprotected in its neighbour. This naturally leads to the taking of protected animals near the border in a protection State, and their disposal in the adjoining State where the animals are unprotected. To police the vast extent of the boundaries between, say, New South Wales and Queensland, or between South and Western Australia, would involve an intolerable burden of expense; whereas if legislation were uniform for all the mainland States administration would be greatly simplified, and the detection of offenders be rendered comparatively easy.

Further, as regards the island State of Tasmania, the game laws are more advanced than those of any of the mainland States, and there is a provision for payment of a royalty which yields a handsome annual revenue. The administration of the Act (The Animals and Birds Protection Act, 1928) is in the hands of a board of nine members, representative of the various interests concerned and the Government, and therefore practically free from political influence.

It is now nearly twelve months since the committee appointed by the State Minister for Agriculture (Mr. Thorby) to inquire into and report upon the possibilities in fur-farming as a commercial proposition brought up their report. As the reference to the committee specified the rabbit, fox, and opossum and other marsupials, the members called evidence ranging over a wide variety of animals, the fur of which might be cultivated on farms or otherwise under control. For the purpose of future reference by members of this Society who may be interested in the subject, I append a copy of the committee's report:—

*Majority Recommendations.*

1. The committee opposes the importation of any species or breed of rabbit, on the grounds (a) that the rabbit is a very serious menace to the primary industries of Australia (rural industries), and causes great losses to them; (b) that there is no evidence that the breeding of rabbits could be regarded as a commercial proposition of a remunerative nature, and likely to provide an avenue of profitable employment; and recommends that rabbit farming be prohibited.
2. As the committee has insufficient evidence to justify it in recommending the introduction of the silver fox, it refrains from making any recommendation.
3. The principle of certain indigenous animals, viz., opossum, wallaby, kangaroos, and water rats, being cultivated on selected forest reserves and other approved localities, for the purpose of fur, is endorsed, subject to necessary safeguards.
4. That steps be taken to study the actual position of indigenous animals with regard to the forest reserves, and that these experiments be conducted on certain islands and in certain forest reserves.
5. The committee recommends that a royalty be charged in respect of all skins of indigenous animals taken for sale, the money so collected to be used for the approved preservation of the flora and fauna of the State.

6. The committee is of opinion that the farming of karakul sheep is worthy of consideration.
7. The committee is of opinion that under our climatic conditions the musquash would probably be no more suitable as a fur-bearing animal than our water rat, and it does not recommend the introduction of this animal into Australia. The committee is further of opinion that the water rat produces a fur that is of some value.
8. The committee is definitely opposed to the introduction for commercial purposes of any carnivorous animal that is not already in this country, including the mink, skunk, lynx, weasel, polecat, and civet cat.
9. The committee recommends that the State Government request the Commonwealth Government to make a biological survey regarding seal life in Australia.
10. The committee recommends that fur-farming of the koala be not permitted, and that permanent protection be continued over this animal and also the platypus.

The minority (four of the ten signatories) considered that rabbit farming should be permitted under certain safeguards. The difference of opinion on this one subject, however, does not concern the subject of my address, which is intended to embrace the indigenous fauna only. As nothing has been done in relation to the committee's recommendations relative to such indigenous fauna, it may be assumed that the principal reason for seeking advice lay in the hope that a new avenue of employment might be opened up in the direction of importing and breeding special kinds of rabbits, foxes, and other exotic animals. The evidence before the committee, much of which was published in the daily press during its sittings, was clearly favourable to the cultivation under domestic conditions of angora, chin-chilla, and beveran rabbits in England, and silver foxes in Canada and the United States. But there was no evidence that either animal could be farmed in Australia as a paying proposition. Initial cost of breeding stock, cost of labour, distance from market, and a host of other considerations made it quite clear (at least to my mind) that the native fauna offered an infinitely better proposition. Here we can get the necessary stock for a nominal amount (say for shillings as compared with pounds for the imported beasts), their food is to a great extent at hand, obtainable at no cost beyond rent of forest lands, the labour required would be less than one-fourth of that required for the rabbit or fox, and the market is also at hand.

If the owner of a well-stocked mixed farm were to allow a neighbour to enter and kill half his pigs because one had broken through the dividing fence and done a little damage on the adjoining farm, or if he were to announce that for part of the year he would throw his farm open to the unrestricted capture or killing of his sheep by any persons who wanted their skins or meat, or if he were to permit a casual stranger to saunter through his poultry yard and shoot or trap half his hens and ducks merely because he (the stranger) wanted to eat or sell the birds, one would suggest that the farmer was not, strictly speaking, a good business man or one likely to succeed in his undertakings. And yet, this is exactly what the owner of that great mixed farm called Australia is doing with the stock placed upon it by Nature. Further, this great farm is divided into six farmlets, each under a separate stock manager, and each has different ideas as to the manner in which the stock should be treated, and the extent to which the neighbour or the casual stranger should be permitted to slay, take, or poison the stock on his farmlet. As a consequence, the stock of one farmlet is



quietly taken, carried across the dividing fence, and disposed of as if it had been taken from the adjoining farmlet whose manager was less alert or desirous of protecting his interests.

If, in the gathering of the season's wool, the grazier were to go out at night and shoot the sheep by moonlight, set traps in likely runways and collect the dead animals after they were cold, or set poison baits and pick up such victims as were discoverable, his methods would be described as somewhat crude. These, however, are the methods commonly adopted by those who gather the fur skins of our native animals. For some years Australian graziers have been studying the best methods of improving their breeds of sheep. Had one-tenth of the time and thought been applied to our native fur-bearing animals, the result would undoubtedly have been to improve their fur and productivity to such an extent as to enormously enhance their value in the world's markets. The silver fox of the Canadian fur farms, after comparatively few years of careful breeding and selection, is almost as far removed from the wild animal as the stud merino of New South Wales is removed from the Spanish merinos imported by Macarthur in the early days of settlement. Experiments in the direction of domesticating and breeding of opossums have been made in Tasmania, South and Western Australia, with some measure of success; sufficient, at any rate, to warrant operations on a larger scale. The black and brush opossums (*Trichosurus* spp.) while usually producing one young one at a time, frequently produce two, and occasionally three, but they have four mammae, and therefore presumably could produce four young. As Nature generally limits the production, according to the food supply, it may be assumed that with an assured and plentiful food supply, under protected conditions, the opossum would rise to the occasion and produce larger litters than in its native state.

For the marsupial fur-bearing animals the present system of alternate open and close seasons should be abandoned, and a system of farming introduced, under which trapping, shooting and poisoning should be absolutely prohibited, and the animals allowed to be taken only under such control as to eliminate the destruction of females carrying young. No doubt the pastoralists and orchardists will exclaim that such a system is impracticable, but if the inspectors or rangers policing the districts were allowed some discretion as to the destruction of any animals becoming an undoubted pest in any locality, the increased value of the animals under proper cultivation would reduce the probability of their becoming a pest to a minimum.

My proposal is to license every collector of skins so as to control the taking at its source; to lease Crown lands and forest reserves at nominal rentals per acre for the purpose of fur-farming; to permit of the disposal of all skins for local consumption at a small royalty per skin; to impose an export duty of a larger amount on all skins despatched beyond the Commonwealth; to prohibit the killing of females of breeding age; and to require that all animals killed shall be humanely dealt with. The quality of a skin is greatly improved if removed immediately after death. The present method of trapping or poisoning militates greatly against the quality of the skins.

Every encouragement should be offered to persons who are prepared to undertake fur-farming, and every obstacle should be placed in the way of the nomadic hunter and trapper.

#### *Effectual Control.*

Our native fauna recognise no political boundaries. They roam, fly, or swim as the urge for food moves them, or the climatic conditions suit

them. The only boundaries they recognise are natural barriers, such as oceans or deserts, and these even are overcome by certain marine animals in the one case, and birds in the other. The control of our native fauna should, therefore, be national; in other words, it should be vested in the Commonwealth. The danger of divided control under States without uniform legislation has already been commented upon. It may be argued that Commonwealth control could not be effectively carried out, but if it is possible to effectively control navigation, posts, telegraphs and other utilities, it should not be difficult to apply the same control to the fauna. Uniformity of treatment would be at least largely beneficial; the methods of control would be concentrated in one Department and the overhead expenses consequently reduced; the aggregate income from licenses, royalties, and export duties (the latter of which could only be imposed by the Commonwealth) would provide for the proper policing of reserves, the observance of the regulations, and the encouragement of experimental work in regard to the improvement of our furs by careful selection and breeding under semi-domestic conditions. Under this control also the at present almost uncontrolled harvesting of our marine riches, actual and potential, of pearlshell, trochus, beche-de-mer, food fishes, whales, and seals, could be fostered and wisely directed, to the exclusion of the foreign element of intrusion, which now reaps so much of what should be gathered by and for Australians.

The savage and senseless slaughter of our wonderful furred and feathered fauna, the wasteful harvesting of our marine riches, and the neglect to make proper provision for the preservation and study of the economically valueless but scientifically priceless animals, all call for strong legislative measures and undivided control.

*Value of Exports from Australia, 1921-1928,  
of Australian Furred-Skins and Marine Products.*

Year.	Furred Skins.			Total.
	Opossum. £	Kangaroo. £	Wallaby. £	
1921-2 . . . . .	224,089	170,669	9,873	404,631
1922-3 . . . . .	498,184	273,977	37,790	809,951
1923-4 . . . . .	410,660	290,809	57,306	758,775
1924-5 . . . . .	127,774	182,009	55,653	365,436
1925-6 . . . . .	362,406	154,476	74,464	591,346
1926-7 . . . . .	921,833	137,994	46,655	1,106,482
1927-8 . . . . .	538,815	200,781	42,184	781,780
	Marine Products.			Total
	Pearl-shell. £	Trochus-shell. £	Beche-de-mer. £	
1921-2 . . . . .	317,623	26,285	No record	343,908
1922-3 . . . . .	320,602	25,095	No record	345,697
1923-4 . . . . .	377,313	23,142	No record	400,455
1924-5 . . . . .	413,095	47,892	No record	460,987
1925-6 . . . . .	391,695	76,280	3,940	471,915
1926-7 . . . . .	352,626	72,812	18,443	443,881
1927-8 . . . . .	337,469	76,116	22,666	436,251

*Note.*—The exports of native bear, wombat and other marsupial skins are not recorded separately, but appear to be incorporated under one heading, "other skins," which may include domestic animals.

Statistics relative to marsupial skins taken in Tasmania during the years 1923-27. There was an open season for three months in 1920, followed by a close season for two years. The periods of open season are shown under each year in the following table:—

<i>Species.</i>	3 months.	2 months.	3 months.	2 months.	2 months.
	1923.	1924.	1925.	1926.	1927.
Kangaroo . . . .	146,236	59,448	75,979	66,114	53,471
Wallaby . . . .	201,365	86,393	121,245	94,531	75,402
Brush Opossum . .	105,968	45,978	60,212	49,737	42,617
Ringtail Opossum .	587,179	273,421	596,526	634,620	603,863
Total Skins .	1,040,748	465,240	853,962	845,002	775,353
Royalties and Licenses collected	£20,000	£10,000	£14,000	£13,000	£11,500
Total skins taken in five years . . . . .					3,980,305
Total royalties and licenses collected . . . .					£68,500

## REPORTS OF THE SECTIONS.

### ENTOMOLOGICAL SECTION.

Ten meetings were held during the year, the number of members and visitors present averaging eleven. A series of interesting lecturettes was delivered by members, in some cases illustrated by lantern slides.

Numerous and varied specimens of insects were exhibited by members.

### BIOLOGICAL SURVEY SECTION.

Regular quarterly meetings of this section have been held, with an average attendance of eleven. In addition, there have been several committee meetings.

Physiographical and geological studies of sections of National Park have reached an advanced stage. Fuller use has been made of the cottage at Gundamaian, placed at the Society's disposal by the National Park Trust, and different week-ends have been allotted to the various sections. The ornithologists and entomologists have been most active as regards zoological work, but marine biology has recently received attention also, particular attention having been paid to the mangrove area. Botanical work has been carried on as before. Group leaders have been co-ordinating the work done on certain problems by groups of members. A room in the cottage has been allotted to a man whose services will be available as boatman, etc., when required.

The proposal to prepare a popular handbook of the natural history of National Park is still under consideration, and collections and observations have been made with that end in view. Popular and scientific names for the more prominent trees and plants in the Park are being supplied for the same purpose and for labels.

GILBERT P. WHITLEY, Hon. Secretary.



## MARINE ZOOLOGICAL SECTION.

The third year's activities of this section have been brought to a successful close. There has been much of mutual interest to discuss among the members, and those who have been absent for periods in the field have enthusiastically figured in the excellent programme of lectures which has been a feature of the meetings.

Lectures delivered during the year were as follows:—

July 2nd.—“Marine Ecology of the Islands of the Capricorn Group, Queensland.” By Mel. Ward.

August 6th.—“True Fish Stories.” By G. P. Whitley.

September 3rd.—“Ten Months Marooned on the Kermadec Islands.” By Tom Iredale.

October 8th.—“Lord Howe Island—the Madeira of the Pacific.” By A. Musgrave.

November 5th.—“The Oyster Resources of Queensland.” By T. C. Roughley.

December 19th.—“The Great Barrier Reef of Australia.” Contributed in the form of lecturettes by Messrs. T. C. Roughley, W. Boardman, Tom Iredale, F. A. McNeill, and H. S. Mort.

February 4th.—“The Story of the Freshwater Eel.” By G. P. Whitley.

March 4th.—“Beachcombing in Torres Strait.” By Mel. Ward.

April 8th.—“The Deep-sea Exploration of the Danish Survey Ship ‘Dana.’” By T. C. Roughley.

May 6th.—“Crustacean Ecology.” By Mel. Ward.

June 10th.—“The Work Accomplished by the Members of the British Great Barrier Reef Expedition at Low Isles, North Queensland.” By Tom Iredale.

Messrs. T. C. Roughley, T. Iredale, F. A. McNeill, G. P. Whitley, W. Boardman, A. A. Livingstone, and H. S. Mort were the guests of the British Expedition, at their headquarters on Low Isles, North Queensland, for varied periods, and brought back much valuable knowledge of the Great Barrier Reef and its fauna. Chairman T. C. Roughley also looked into the oyster resources of Queensland at the request of the Government of that State, and the recounting of his experiences proved of great interest. A collecting trip of three months' duration enabled Mr. Mel. Ward to gather a wealth of information about the islands of Torres Strait, particularly the crustacean fauna; his experiences formed the subject of one of our most interesting lectures.

Much assistance was given by members of the section to the personnel of the Danish survey ship, “Dana,” while they stayed in Sydney for several weeks during their world tour. Chairman T. C. Roughley and Mr. G. P. Whitley accompanied the “Dana” on a cruise of the coastal waters between Sydney and Brisbane, and about six members of the section also helped to entertain the scientific officers of the ship with a motor picnic to Leura and Katoomba on the Blue Mountains.

The December meeting of the section was again treated as a social night, and the office-bearers endeavoured to foster the Xmas spirit among members, who were asked to attend in strength with their friends. Special arrangements were made for suitable refreshments, and the evening was a marked success.

Assistance from the section has been promised concerning the problems associated with the biological survey of National Park, and with this in view several members visited the Society's premises at Gundamaian on June 21. A preliminary survey of the marine possibilities of the area was

made, and the matter discussed at length on the monthly meeting night of July 1.

Several additional members have been added to the ranks during the year, including Professor W. J. Dakin, the enthusiastic zoologist, lately appointed to the University chair, formerly held by the late Professor Launcelot Harrison.

Meetings have been well attended, and the system of encouraging visitors has tended to brighten the proceedings, as well as winning new members for the section.

T. C. ROUGHLEY, Chairman.

F. A. McNEILL, Hon. Secretary.

#### ORNITHOLOGICAL SECTION.

Increased attendances at meetings, the many excellent lectures, and the very fine collections of photographs exhibited, made the past year a most successful one.

The field outings to interesting bird localities, besides adding greatly to our knowledge of many species, and to the collections of our nature photographers, proved both instructive and enjoyable. The success of these "outings" is due to the leadership of Mr. K. A. Hindwood, our enthusiastic hon. secretary.

Ideal weather conditions, a fruitful bird locality, and a hard-working body of enthusiasts, crowned with success the section's first extended field excursion, held at Port Stephens during November of last year. One hundred and twenty-nine species of birds were observed, and many fine photographs were secured. We here take this opportunity of thanking Mr. W. J. Enright, of West Maitland, for his kindly help and advice, which were greatly appreciated. During the coming season it is proposed to hold another "camp-out," the locality to be visited will be decided later.

The field observations made by members and recorded at each meeting have proved of outstanding interest; these are included in the minutes and in time will be of great value, especially when the proposed popular handbook is being compiled.

To Mr. Tom Iredale we offer our thanks and congratulations on his two great "finds"; his success in procuring on Manly Beach one specimen each of the Grey Noddy (*Procelsterna albigutta*), and the Lord Howe Island Petrel (*Pterodroma melanopus*), was a fitting reward after five years' intensive search.

Many enjoyable week-ends have been spent at the bird cabin and at Gundamaian cottage by parties of our members. More accommodation is needed at both places, and members are advised that a caretaker and a boat have been procured for the cottage by the Society, but funds are required to purchase more stretchers, blankets, and other camp equipment.

Much useful work is being done by the other sections on the biological survey of National Park, and it is hoped that members of this section will do their share of the survey. Gundamaian cottage is available to our members on the fourth week-end of each month, and all wishing to participate are invited to attend.

A summary of the lecturettes given during the past year is as follows:—

August 17, 1928.—Mr. C. Price Conigrave, a lecture, entitled: "Tramping in Northern Australia," beautifully illustrated with lantern slides.

September 21, 1928.—Messrs. A. H. Chisholm and N. W. Cayley, an address on "Australian Parrots," illustrated with water-colour drawings by the latter.

October 26, 1928.—Mr. A. S. Le Souef, "Observations on the Birds of Hinchinbrook Island," Queensland.

Mr. A. A. Lawson, an address on the three-colour process, illustrated with lantern slides made by the process.

Mr. E. Gostelow exhibited a fine collection of his paintings of Australian parrots.

November 15, 1928.—Mr. K. A. Hindwood, a lecture on "Birds and the Bush," excellently illustrated with his photographs.

December 21, 1928.—The Port Stephens excursion, by Messrs. A. H. Chisholm, P. A. Gilbert, N. W. Cayley, and H. H. Innes.

January 18, 1929.—Mr. Norman Chaffer exhibited a very fine collection of his photographs as lantern slides.

February 15, 1929.—Mr. Tom Iredale led a discussion on the "Fairy Wrens of Australia," supported by Messrs. A. H. Chisholm, N. W. Cayley, and P. A. Gilbert. Mr. Cayley exhibited water-colour drawings of all the species.

March 15, 1929.—Mr. E. F. Pollock exhibited his collection of lantern slides (a very fine lot), the majority being the work of Messrs. Otho Webb and David Gaukrodger.

April 19, 1929.—Mr. P. E. B. Barnett gave an "Illustrated Travel Talk," the photographs, taken during his tour abroad, being fine examples.

May 17, 1929.—Mr. C. Price Conigrave gave a most interesting and instructive lecture, entitled: "Tramping in Papua," excellently illustrated.

#### SECTIONAL MEETINGS.

##### *Syllabus for the year 1929-30.*

##### *Biological Survey Section:—*

Wednesday, 21 August, 20 November, 1929; 19 February, 21 May, 1930.

##### *Entomological Section:—*

Wednesday, 10 July,	1929.
14 August,	"
11 September,	"
9 October,	"
13 November,	"
12 February,	1930.
12 March,	"
9 April,	"
14 May,	"
11 June,	"

##### *Marine Zoological Section:—*

Monday, 12 August,	1929.
2 September,	"
14 October,	"
4 November,	"
2 December,	"
3 February,	1930.
3 March,	"
7 April,	"
5 May,	"
2 June,	"

##### *Ornithological Section:—*

Friday, 19 July,	1929.	17 January,	1930.
16 August,	"	21 February,	"
20 September,	"	21 March,	"
18 October,	"	18 April,	"
15 November,	"	16 May,	"
20 December,	"	20 June,	"

Meetings of Sections are held at the Society's office, Bull's Chambers, 28 Martin Place, at 7.30 p.m., and are open to all members and their friends.



# REVISIONAL NOTES ON AUSTRALIAN THEREVIDAE.

By JOHN S. MANN.

## Part 2.

### Introduction.

In the first paper of this series \*, Group 1 of the family, with the exception of two genera (*Psilocephala* and *Belonalys*), was completely revised. It has not been possible in these pages to fully revise Group 2, but the important and larger genera have been considered, and the others will be, in a subsequent paper. It must be stressed that these are "Revisional Notes" only, and, as was pointed out previously, insufficient material is available to allow of a complete revision of the family.

As a result of acquiring much additional material, it has been found that many characters used by previous authors for the establishment of their generic conceptions are not of sufficient importance to clearly separate many of such genera. These examples are noted in the discussion on the various generic divisions.

In these notes five genera are dealt with, twelve species are described as new and ten of the old descriptions are revised.

### Key to the Genera of Group 2.

1. Scutellum triangular and perpendicularly raised, all small species. . . . . *Acraspisa* Krober.  
Scutellum normally semicircular. . . . . 2.
2. Antennae slightly or greatly longer than the head. . . . . 3.  
Antennae shorter than the head. . . . . 4.
3. Palpi one segmented, attenuated, labella of proboscis reduced; males with part of the abdomen silvery pollinose and considerably flattened above and below in both sexes; antennae slightly longer than the head; style two-segmented; head more or less pyriform; face protruding. . . . . *Acupalpa* Krober.  
Palpi two-segmented; labella not reduced; abdomen of males in no wise pollinose; cylindrical in both sexes; antennae considerably longer than the head; style one-segmented; head subhemispherical. . . . . *Agapophytus* Guerin.
4. Small species with enlarged hypopygium and silvery pollinose abdomen in the males; eyes with a transverse furrow; wings banded; elongated hind legs with the femora flattened on the sides and bearing a row of bristles. . . . . *Acatopygia* Krober.  
Moderate to large species with abdomen and hypopygium of males not as above; eyes normal; wings not banded, at most clouded only. . . . . *Lonchorhynchus* White.

Note: Determinations of genera should be checked by the descriptions as there are possibly new genera in collections which have not been made available to me. Three genera of the group are not included in the above

\* *Aust. Zool.*, v., 1928, 151.

key as they have not been correctly determined; of these, *Pseudoloxocera*, is not considered valid (vide notes under the description of *A. obscuripes*), *Spatulipalpa* has not been recognised, and, if my determination of *Parapsilocephala* is correct, it can be distinguished from the two lastnamed genera as follows: From *Actopygia* by the uniformly cylindrical abdomen, and from *Lonchorhynchus* by its small size and by having the eyes touching in the males.

*Oldenbergia* is possibly a synonym of *Parapsilocephala*.

#### Genus ACRASPISA.

*Acraspisa* Kroker, Ent. Mitt., 1, p. 286, 1912.

Small species with the head distinctly pyriform and flattened above; slightly broader than long and about as broad as the thorax; occiput deeply concave (except in *trifasciata*) and fringed with black bristles; eyes bare, very large and descending well down on to the cheeks and divided by an indistinct transverse furrow which is level with the antennae, touching in the males for a short distance and separated in the females; ocellar tubercle oval, slightly raised and bearing tufts of short hair; ocelli three in number; front small and triangular in the males and uniformly broadening in the females; antennae shorter than the head and in relation to the anterior margin of the eyes they are inserted at something below two-thirds its depth and they project forward so that they and the flattened frons are on one plane, composed of three segments, the basal one of which is short, stout and cylindrical and never more than twice as long as the second which is more or less globular and flattened at the extremities, segment three is irregularly conical and may be slightly broader than the other segments when viewed in profile; style two segmented the apical segment being very small and often retracted into the basal and is thus often difficult to discern; the arista is never longer than the style; face and cheeks very small, the latter bearing long fine hair; proboscis projecting forwards somewhat; palpi composed of one broadly conical segment which is short haired.

The thorax is slightly longer than and as deep as broad, one and one half times as long as the head, very convex above and almost bare of pubescence, but bearing a few bristles (slightly tomentose with a few hairs in *trifasciata*); the scutellum is triangular and raised to become perpendicular and is fully twice as long as its greatest width, it bears two ventral marginal bristles; postscutellum convex and well hidden beneath the scutellum.

The abdomen may be more than twice as long as but is slightly narrower than the thorax, flattened above and below and somewhat clavate at the extremity.

The legs are normal in length, the tibiae and tarsi bear numerous bristles, but the femora are devoid of such.

Wings banded; M3 and M4, similarly with Cu1 and 1A coalesce well before the wing border, the origination of M1 and M2 is subject to considerable variation (vide notes under the description of *obscuripes*); costa and hind margin ciliated.

The sexes may be dissimilar in general coloration, but individually, except for the veins M1 and M2, the specimens of any species show little or no variation.

Genotype: *Acraspisa trifasciata* Kroker. In the Hamburg Museum.

Kroker erected the genus on one male from Peak Downs (Northern Territory).

Range: Australia only.

Distribution: The typical species extends from New South Wales to the Northern Territory; the other two are known from Queensland only.

The primary character given by Krober when he proposed this genus was that of the perpendicularly raised and triangular scutellum. This character alone would not be of sufficient importance to establish the genus for it has been used with disastrous results in STRATIOMYIIDAE. *Pachygaster* has been split up into an enormous number of genera, several of which have been based on this very character and there is nothing to indicate that these conceptions are more than arbitrary. The genus *Lecomyia* contains species in which the scutellum is both upraised and normal, and in such cases there is no dispute about these species being congeneric. With this in mind one cannot help viewing the character in THEREVIDAE with some doubt, but in the case of this genus there are several quite good supporting characters and the group as herein described is very homogeneous.

*Key to the species of Acraspisa Krober.*

- |   |                            |
|---|----------------------------|
| 1. Males. . . . .   | 2.                         |
| Females. . . . .  | 4.                         |
| 2. Thorax bright brown with a shining black anterior dorsal area. . . . .                       | <i>nigrinota</i> sp. nov.  |
| Thorax shining or dull black. . . . .   | 3.                         |
| 3. Thorax grey tomentose; scutellum brown and legs mainly brown. . . . .                        | <i>trifasciata</i> Krober. |
| Thorax without grey tomentum, shining black; scutellum shining black; legs black brown. . . . . | <i>obscuripes</i> sp. nov. |
| 4. Thorax dull black above. . . . .   | <i>trifasciata</i> Krober. |
| Thorax red-brown; legs mainly black. . . . .  | <i>obscuripes</i> sp. nov. |
| Thorax bright brown; legs bright yellow-brown. . . . .  | <i>nigrinota</i> sp. nov.  |

In the material before me I have two females, of another new species, which are closely allied to *obscuripes*, and three of yet another species which are apparently nearly related to *trifasciata*. I am refraining from describing these until more are available, and since the males may be somewhat diverse in general coloration, it would certainly be better to have these for description at the same time.

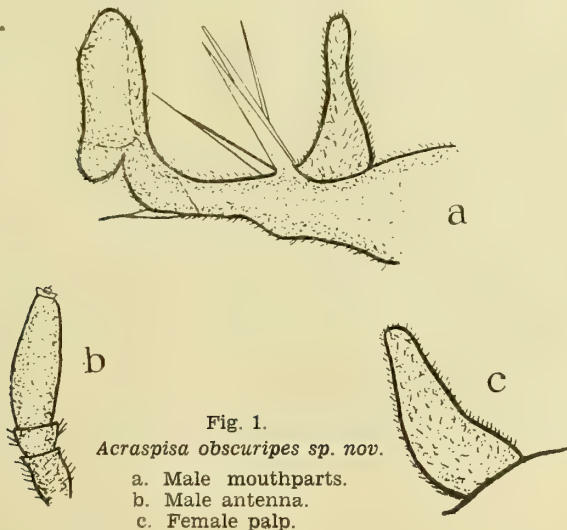


Fig. 1.

*Acraspisa obscuripes* sp. nov.

- a. Male mouthparts.  
b. Male antenna.  
c. Female palp.



## ACRASPISA TRIFASCIATA.

*Acraspisa trifasciata* Krober, Ent. Mitt., 1, p. 286, 1912.

Length: 6-8 mm.

*Male*: Head with the occiput dull black, more or less straight but slightly indented medianly, sparsely fringed with black bristles; eyes separated on the vertex by the width of the ocellar tubercle, but contiguous for two-thirds the distance below this towards the antennae and from thence they somewhat sinuously diverge; ocelli brown; front black, grey tomentose; antennae dull brown with black reflections, segment 1 less than twice as long as 2; 3 slightly more than three times as long as 1 and twice as long as 1 and 2 united; the style is almost one-fourth the length of the first antennal segment; the arista is two-thirds the length of the style; face and cheeks black-brown, the latter bearing black hair; proboscis and palpi black with black hairs, and the former projects as far forward as the apex of the second antennal segment, and the latter is two-thirds the length of the former.

Thorax dull black, covered with grey tomentum and fine black hair; furnished with 3 pre-alar, 1 inter-alar and 2 post-alar bristles; pleurae black, grey tomentose; scutellum brown; postscutellum black.

Abdomen two and one half times as long as the thorax, straight sided; brown with black reflections; segments 4-5 almost wholly black; venter similarly coloured; genitalia bright brown.

Legs brown, hind tibiae and tarsi mainly black.

Wings hyaline, banded with three irregular grey cross bands, one crossing the basal cells, one the median and one just prior to the tip; the extreme tip is grey; veins M1 and M2 arise together from the corner of the median cell which is considerably broader, but hardly as long as cell M3.

The female differs from the male, in having the eyes separated on the vertex by twice the width of the ocellar tubercle and the anterior margins straight and uniformly diverging, the thorax with reddish pleurae and the abdomen almost wholly black and darker banded wings. The genital spines are reddish.

*Habitat*: Northern Territory; Daley River (♂, no date given). This specimen is in the South Australian Museum; New South Wales; Forest Reefs (1 ♀, Lea., no date given). This has been made the female allotype and has been deposited in the Queensland Museum, No. 3505.

Krober originally described the species from a male taken at Peak Downs (Northern Territory ?) and lodged the type in the Hamburg Museum.

## ACRASPISA NIGRINOTA sp. nov.

Length: 6-9 mm.

*Male*: Head with the occiput shining black; eyes separated on the vertex by the width of the ocellar tubercle and touching below this for two-thirds the length of the front and from thence diverging with the anterior margins slightly concave; ocelli bright brown; front shining black, ornamented with a fine median longitudinal furrow, bare; antennae brown with segment 1 half as long again as 2; 3 is almost four times as long as 1 and 2 united and is hardly broader than the other segments; the arista is less than one half the length of the style; proboscis brown, projecting as far forward as the apex of the first antennal segment; palpi brown and nearly as long as the proboscis.

Thorax bright brown with an anterior dorsal area of shining black; furnished with 1 pre-alar, 1 inter-alar, 1 post-alar and 4-6 pre-scutellar bristles; pleurae, scutellum and postscutellum bright brown.

Abdomen twice as long as the thorax; tapering; shining black, black haired; venter black with brown reflections; genitalia light brown.

Legs bright yellow-brown with brown reflections; anterior tarsi black.

Wings hyaline with three irregular grey cross bands, the central one of which is broad and extends from the base to the apex of the median cell, the others are narrow; veins M1 and M2 arise together from the median cell and are joined for a short distance before branching; cell M3 is slightly longer and broader than the median.

The female differs from the male in having the eyes separated on the vertex by three times the width of the ocellar tubercle, with the anterior margins straight and uniformly diverging, the front shining black and the intermediate tarsi as well as the anterior, black. The genital spines are brown.

Variations: The intermediate tarsi of the male may be brown also.

Holotype: Male, Gogango (A. P. Dodd, December, 1928), in the Queensland Museum, No. 3281.

Allotype: Female, Brisbane (G. H. Hardy, October, 1928), and in his collection in Brisbane.

Paratype: Male, Gogango (A. P. Dodd, December, 1928), in the author's collection.

Habitat: As above, Gogango and Brisbane, Queensland.

The species is distinguished from the others by the general colour.

*ACRASPISA OBSCURIPES sp. nov.*

Length: 5-8 mm.

*Male:* Head with the occiput shining black; eyes separated on the vertex by the width of the ocellar tubercle and contiguous below this for half the distance to the antennae and from thence broadly diverging with the anterior margins somewhat concave; ocellar tubercle black; ocelli bright brown; front black, grey tomentose; antennae black with some brown reflections, segment 1, twice as long as 2; 3, three times as long as 1 and broader than the other segments; arista one-fourth the length of the style; face and cheeks black, grey tomentose and the latter bearing greyish hairs; proboscis and palpi black, black haired, the former projects as far forward as the middle of the third antennal segment and the latter are two-thirds the length of the former.

The thorax is shining black and is furnished with 3 pre-alar, 1 inter-alar, 2 post-alar and 6 pre-scutellar bristles, all of which are black and weakly developed; pleurae, scutellum and postscutellum shining black.

Abdomen one and one half times as long as the thorax, straight sided and shining black with segments 1-3 mainly dull brown; the whole black and brown haired; venter shining black; genitalia bright brown.

Legs black-brown, somewhat brown at the base of the tarsi.

Wings hyaline with three faint grey narrow cross bands, one near the base, one at the apex of the median cell and the other just prior to the wing tip; veins M3 and M4 similarly with Cu1 and 1A meet well before the border; M1 and M2 issue from the median cell together and are joined for a short distance before branching away from each other; cell M3 and the median are about the same size.

The female differs from the male considerably: Eyes separated on the vertex by twice the width of the ocellar tubercle and then uniformly diverging with the anterior margins straight; front dull black, white at the eye margins and finely striated; thorax wholly red-brown with black reflections anteriorly and laterally; pleurae red-brown with a silver longitudinal stripe just above the coxae; scutellum bright brown with black margins; segments

2-3 of abdomen bright brown. The genital spines are black and weakly developed.

Variations: The antennae may be almost entirely brown and veins M1 and M2 may vary considerably in their origin, and instead of arising as herein described they may be normal or issue as in *trifasciata*. In this connection it might be mentioned that Krober (Ent. Mitt., 1, p. 286, 1912) erected the genus *Pseudoloxocera* on a female specimen of an insect from Peak Downs, and used, as the primary character for the genus, the fact that the veins M1 and M2 arose "together as forked veins from the upper corner of the discoidal cell." In view of the aforementioned gradation of the character, this genus could not possibly be maintained without supporting structural differences. As the species is unknown to me the question of the possible synonymy of *Pseudoloxocera* will have to be left in abeyance.

Holotype and Allotype (G. H. Hardy, Brisbane, March, 1929, *in copula*) in G. H. Hardy's collection, Brisbane. Paratypes in the Queensland Museum and in the author's collection.

Habitat: Queensland, Brisbane (H. Hacker, 10 ♂, 1 ♀, September, 1914), Chinchilla (A. P. Dodd, 3 ♂, November, 1927).

The species is readily separated from the other members of the genus in both sexes by the general coloration.

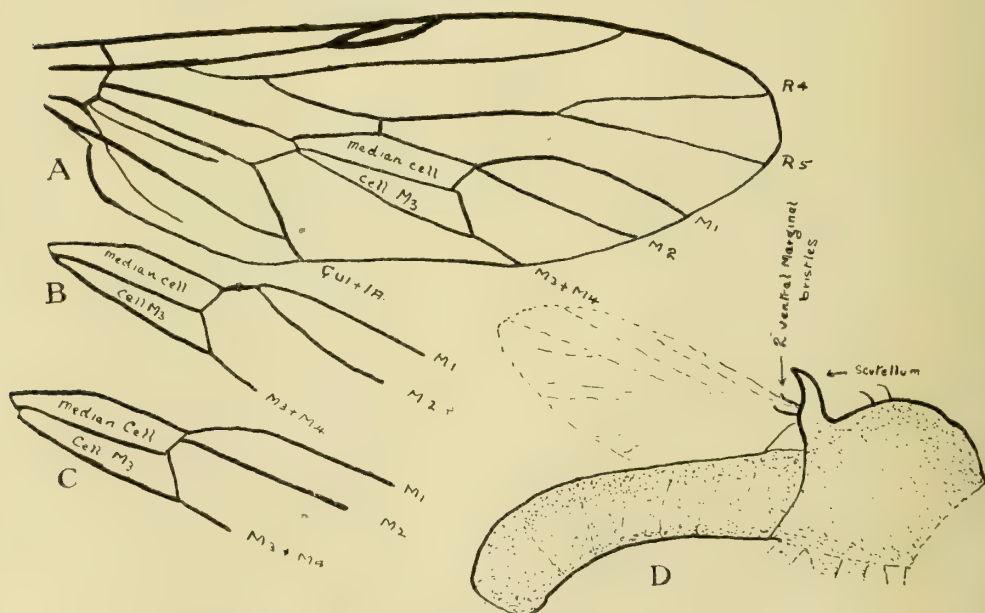


Fig. 2.

*Acraspisa obscuripes* sp. nov.

- A. Complete wing.
- B. } Showing variations in the origin of veins M1 and M2.
- C. }
- D. Thorax, lateral view, to show scutellum and the two ventral marginal bristles.



## Genus ACUPALPA.

*Acupalpa* Krober, Ent. Mitt., 1, p. 152, 1912.

Moderately sized species with the head sub-hemispherical, slightly or considerably flattened above, slightly broader than the thorax, distinctly broader than long; occiput slightly or deeply concave and fringed with black hairs and bristles; eyes large, bare, separated in both sexes, but more so in the female than in the male, anterior margin convex, or straight, facets uniform; ocellar tubercle large, oval and raised; front bare, sparsely pubescent or somewhat sculptured; antennal tubercle prominent, sometimes bilobate, always bare; antennae, in relation to the anterior margin of the eye, are inserted at about half its depth, separated at the base with the first segments parallel and the remainder divergent, longer than the head, segment 1 cylindrical, beset with black hairs and bristles, segment 2 somewhat globular and flattened at the extremities and also beset with black hairs and bristles, segment 3 elongate-conical or irregularly cylindrical when viewed in profile, sometimes broader than the other segments, haired at the base only in most instances; style one-segmented (composed of 2 segments in *semirufa*); arista present and rather stoutly developed; face produced bulbous-like and projecting forwards; bare or pubescent; cheeks receding and clothed with long fine hair; proboscis elongate, projecting as far forward as the apex of the antennae, labella reduced in comparison with those of other genera, base narrowed; palpi one-segmented (two-segmented in *pollinosa*) and almost as long as the proboscis, somewhat sharp pointed, pubescent.

Thorax convex above, longer than the head, furnished with 3-4 pre-alar, 1-3 inter-alar, 0-1 post-alar and 2-4 pre-scutellar bristles, all of which are black; scutellum semicircular and armed with 2-4 marginal bristles; postscutellum convex and well hidden beneath the scutellum.

Abdomen one and one half to twice as long as and as broad as or slightly broader than the thorax; flattened dorsally; straight-sided; silvery pollinose in the males.

The legs are of moderate length; the tibiae and tarsi bear numerous bristles; the femora are haired but devoid of bristles.

The wings are banded, always longer than the abdomen; veins M3 and M4 similarly with Cu1 and 1A coalesce well before the border; cell M3 may be narrower or broader than the median but is always longer; costa and hind margin ciliated; stigma distinct.

The sexes are similar, there being but a slight variation of colour between the usual sexual differences.

Genotype: *Acupalpa rostrata* Krober.

Range: Peculiar to Australia.

Distribution: The typical species is known from Sydney only (the type locality); *albitarsa* and *semirufa* extend from New South Wales to Southern Queensland and the latter has been taken at Mount Tambourine (2,000 ft.); *pollinosa* and *semiflava* are known from Southern Queensland only.

A somewhat heterogeneous collection of species which may, when more material is available, have to be split up in one or two additional genera. *A. pollinosa* and *semirufa* exhibit the greatest amount of divergence from the characteristics of the typical species, the former in having two segmented palpi and the latter a two-segmented style.

The genus is readily recognised by the elongate and somewhat sharp pointed proboscis and palpi together with the protruding face, pollinose abdomen in the males and banded wings.

*Key to the Species of Acupalpa.*

- |  |                           |
|--|---------------------------|
| 1. Abdomen wholly black. . . . .   | 2.                        |
| Abdomen otherwise coloured. . . . .  | 3.                        |
| 2. The four apical tarsal segments of all legs white. . .  | <i>albitarsa</i> sp. nov. |
| The apical half of the basal and the whole of the second anterior tarsal segments, whitish; the basal intermediate and posterior tarsal segments brownish white. . . . . | <i>pollinosa</i> sp. nov. |
| The posterior femora black, others orange; antennae brown. . . . .   | <i>rostrata</i> Krober.   |
| 3. Segments 2-3 of abdomen largely reddish. . . . .  | <i>semirufa</i> sp. nov.  |
| Segments 1-3 of abdomen yellow. . . . .  | <i>semiflava</i> sp. nov. |

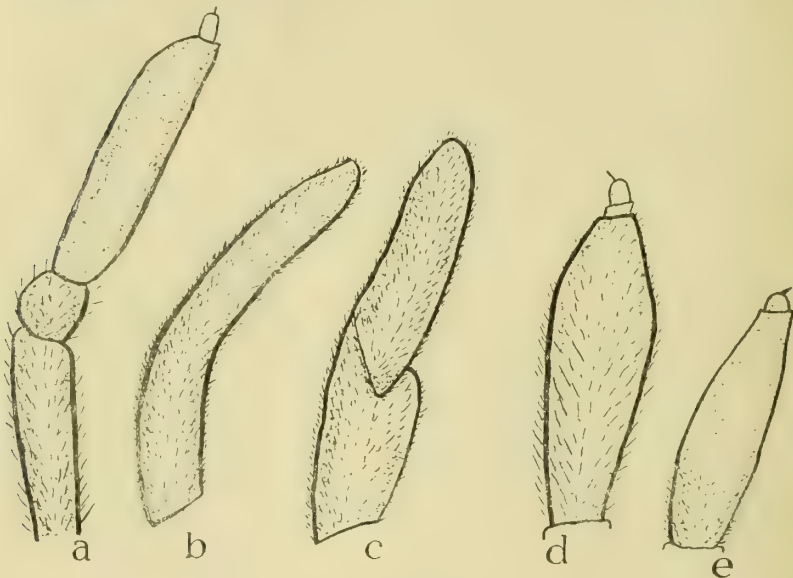


Fig. 3.

- a. antenna of *Acupalpa albitarsa* sp. nov.  
 b. palp of *Acupalpa albitarsa* sp. nov.  
 c. palp of *Acupalpa pollinosa* sp. nov.  
 d. third antennal segment of *Acupalpa rostrata* Krober.  
 e. third antennal segment of *Acupalpa semiflava* sp. nov.

*ACUPALPA ALBITARSA* sp. nov.

Length: 6-9 mm.

*Male*: Head with the occiput deep black, grey at the eye margins, and fringed with a marginal row of rather weak black bristles; eyes separated on the vertex by the width of the ocellar tubercle with the anterior margins straight and parallel for one half of the length of the front and from thence widely diverging; ocellar tubercle dull black ocelli shining brown; front small, dull black with greyish tomentum on the sides and towards the vertex, sparsely covered with black hairs; antennal tubercle dull black;

antennae separated slightly at the base, one and two-third times as long as the head, brown-black with the basal half of the first segment brown; segment 1 almost as long as the head; 2 one-sixth the length of 1; 3 slightly longer than 1, cylindro-conical and furnished with a few black hairs; style broadly conical, its greatest width being almost equal to its length; the arista is one-fourth the length of the style; cheeks dull black; proboscis brown-black; palpi black and almost half the length of the proboscis, beset with short black hair.

Thorax very little longer than and hardly as deep as broad, twice as long as the head; dull black dusted with irregular patches of brown tomentum; covered with black and brown hairs; ornamented with faint indications of fine longitudinal parallel stripes; furnished with 3 pre-alar, 1 inter-alar and 4 pre-scutellar bristles, all of which are black; pleurae black, grey tomentose; scutellum velvet brown-black and bearing 4 black bristles, all of which are but weakly developed; postscutellum black.

Abdomen almost twice as long as and about as broad as the thorax; slightly tapering, somewhat cylindrical; dull black; segments 2-3 slightly silvery pollinose, apically margined white and with an irregular triangular median brown area; vertex shining black; genitalia brown.

Legs brown-black; the bases of the fore and middle tibiae somewhat lighter; the four apical tarsal segments of all legs white.

Wings hyaline with the tip and two indistinct cross bands brown; one band extends from the base to the apices of the basal cells where it is irregularly confluent with the other which crosses the median cell; cell M3 considerably narrower but slightly longer than the median. The halteres are bright yellow.

The female is unknown.

Variations: The thoracic stripes and wing banding may be more or less distinct; the silvery pollen on the abdomen may extend from the first to the third segment and the first may be also apically margined white.

Holotype: Male, Brisbane (H. Hacker, September, 1914), is in the Queensland Museum, No. 3282, together with 10 paratypes; 2 paratypes in Dr. I. M. Mackerras' collection, Sydney, and one in Dr. A. J. Nicholson's, at the Sydney University.

Habitat: Queensland, Brisbane (19 ♂, H. Hacker, September, 1914); New South Wales, Woodford (2 ♂, I. M. Mackerras, November, 1925); Como (♂, A. J. Nicholson, November, 1923).

The species differs from the genotype in having a distinctly less pyriform head and a slightly more cylindrical and less flattened abdomen, but I do not consider that these are of sufficient importance to warrant placing same in some other genus.

Readily distinguished from *semirufa* and *semiflava* by the all black abdomen and from *rostrata* and *pollinosa* by the colour of the legs.

ACUPALPA POLLINOSA sp. nov.

Length: 6-9 mm.

*Male*: Head with the occiput deeply concave, shining black and fringed with black hairs and bristles; eyes separated on the vertex by the width of the ocellar tubercle, converging very slightly below this for a short distance and from thence convexly diverging; ocellar tubercle black; ocelli dark brown; front small and narrow, black, ornamented with a small tubercle just below the ocelli and with faint indications of diagonal striae; antennal tubercle divided longitudinally for half the length by a deep and narrow furrow, shining black; antennae slightly longer than the head, black-brown with segment 1 almost three times as long as 2 which is slightly less than one-fifth the length of 3; 3 is irregularly cylindrical, twice as long as 1 and



longer than 1 and 2 united, hardly broader than 2 at its broadest point and furnished with long black hair near the base; style and arista very short and united, they are about half the length of the second antennal segment; face shining black, swollen bulbous-like and projecting as far forward as the antennal tubercle, clothed with long black hair; cheeks dull black becoming grey under the eyes and bearing white and blackish hairs; proboscis brown-black covered with short black hair; palpi black covered with short black hair and three-fourths the length of the proboscis, 2 segmented, the basal segment being stouter and one-third the length of the apical.

Thorax slightly longer than and about as deep as broad, slightly more than twice as long as the head; black, with the anterior margin and the anterior-lateral angles greyish and with indications of two parallel longitudinal greyish stripes; humeral calli shining black; furnished with 3 pre-alar, 1-2 inter-alar, 1 post-alar, and 4 pre-scutellar bristles, all of which are long, black and weakly developed; pleurae black, grey tomentose; scutellum shining black furnished with 2 long convergent marginal bristles; postscutellum dull black.

Abdomen slightly more than twice as long as and as broad as the thorax; tapering very slightly; black, segments 1-4 silvery pollinose; 3 apically margined white; clothed with rather long white and black hairs; venter similarly coloured, except for the silvery pollen; genitalia brown.

Legs black with some brown reflections; the apical half of the basal and the whole of the second anterior tarsal segments whitish; the basal intermediate and posterior tarsal segments brownish-white.

Wings slightly longer than the abdomen, three times as long as broad; hyaline, with 3 irregular, dark grey crossbands, one of which crosses the basal cells at the apex, and is as broad as half their length, the second crosses at the median cell and is as broad as that cell is long, the third is faint and narrow and crosses at the fork of R4 and R5; cell M3 is broader and longer than the median. The halteres are brown with pale yellow apices.

The female is unknown.

Holotype: Male, Brisbane (H. Hacker, September, 1914), in the Queensland Museum, No. 3283.

Paratypes in the Queensland Museum and the author's collection.

Habitat: Queensland, Brisbane (H. Hacker, 7 ♂, September, 1914), Caloundra (H. Hacker, 1 ♂, October, 1913).

*A. pollinosa* differs from the typical species in having two-segmented palpi; it may not be con-generic, but I cannot find any other structural differences of sufficient importance to justify making a new genus.

The species is separated from *semirufa* and *semiflava* by the colour of the abdomen, from *rostrata* by the colour of the femora and from *albitarsa* by the colour of the tarsi.

#### ACUPALPA ROSTRATA.

*Acupalpa rostrata* Krober, Ent. Mitt., 1, p. 152, 1912.

Length: 8-10 mm.

*Male*: Head flattened considerably above; occiput slightly concave, black; eyes separated on the vertex by slightly more than the width of the ocellar tubercle, slightly convexly diverging below this for one-third the length of the front and from thence more abruptly, the anterior margin is convex; ocellar tubercle black, ocelli brown; front dull black, bare; antennal tubercle shining black, covered sparsely with black hairs; antennae slightly longer than the head, segment 1 brown, slightly more than one half the length of 3; 2 brown, one-third the length of 1; 3 slightly longer than 1 and

2 united, elongate conical, black and clothed with long black hairs; arista two-thirds the length of the style; face shining black, covered with rather long black pubescence, swollen bulbous-like and projecting almost as far forward as the antennal tubercle; cheeks shining black, becoming grey under the eyes and bearing grey and blackish hairs; proboscis brown-black; palpi brown-black, almost as long as the proboscis and beset with long black hair.

Thorax very little longer than and hardly as deep as broad, twice as long as the head; black, dusted with grey tomentum; ornamented with three indistinct parallel grey stripes; furnished with rather long black pubescence, 4 pre-alar, 2 inter-alar and 4 pre-scutellar bristles; pleurae similarly coloured; scutellum black and furnished with 4 black bristles; postscutellum black.

Abdomen one and one half times as long as but hardly broader than the thorax, tapering slightly; black, segments 1-4 silvery pollinose, 2 and 3 apically margined white; venter dull black; genitalia brown.

Legs orange; coxae, hind femora except for the extreme apices, apical half of hind tibiae, 3 apical tarsal segments of all legs and apices of fore and middle tibiae black; 2 basal tarsal segments of fore and middle tarsi, white; the orange on the hind legs is somewhat darker than that on the others.

Wings hyaline, with dark grey tip and two bands, one crossing the basal cells and the other the median cell; cell M3 broader and slightly longer than the median cell. The halteres are black with white apices.

The female differs from the male only in having the eyes separated on the vertex by as much again as the width of the ocellar tubercle.

Habitat: New South Wales, Collaroy (1 ♀, V. Irwin-Smith); Ryde (1 ♂, December, 1925); Kogarah (1 ♂, I. M. Mackerras, November, 1927); Manly (2 ♀, November, 1923).

This is the typical form of the genus and can be distinguished from all the others by the colour of the legs, distinct wing banding together with the general black coloration.

*ACUPALPA SEMIRUFA* sp. nov.

Length: 8-14 mm.

*Male:* Head with the occiput slightly concave and black; eyes with the anterior margins convex, separated on the vertex by slightly more than the width of the ocellar tubercle, slightly convexly diverging below this for one-third the length of the frons and from thence more abruptly; ocellar tubercle black; ocelli brown; front black, bare, ornamented with very fine indistinct striae; antennal tubercle shining black, divided longitudinally by a shallow, indistinct groove; antennae brown-black, one and one half times as long as the head, segment 1 slightly more than half the length of 3; 2 about one-third the length of 1; 3 irregularly cylindrical, slightly broader than the other segments, longer than 1 and 2 united and beset with black hairs and pubescence; style two segmented, the first of which is about half the length and slightly broader than the second and both are somewhat rectangular in shape; the arista is about one-fourth the length of the style; face shining black, the lower half produced and divided longitudinally, forming a bilobed bulbous-like protuberance just above the mouth opening, clothed sparsely with black pubescence; cheeks black becoming grey under the eyes and bearing whitish hairs; proboscis brown-black, black haired and projecting as far forward as the middle of the third antennal segment; palpi similarly coloured, almost as long and tapering.

Thorax very little longer than and as deep as broad, three times as long as the head; dull black with indications of three greyish longitudinal

dorsal stripes which become more and more indistinct as they extend towards the scutellum; furnished with black pubescence, 4 pre-alar, 3 inter-alar and 2 pre-scutellar bristles; pleurae black; scutellum black and provided with 4 elongate but weak bristles and fringed with black pubescence; postscutellum dull black.

Abdomen one and one half times as long as and slightly broader than the thorax, covered with silvery pollen and black and white pubescence; black with sides of segments 2-3 largely reddish; venter black segments 2 and 3 reddish; genitalia brown.

Legs reddish; coxae, apices of anterior femora, apical two-thirds of anterior tibiae, apices of intermediate and posterior tibiae, extremities of intermediate and posterior tarsi, basal half of first and the whole of the apical three anterior tarsal segments, black; remaining anterior tarsal segments white and the remainder of the intermediate and posterior tarsi brown.

Wings hyaline with three dark grey bands, the first crossing at the apices of the basal cells, the second the median cell and the third at the tip of the wing; cell M3 both broader and longer than the median; veins yellowish; halteres brown-black with yellow apices.

The female differs from the male as follows: Eyes separated on the vertex by as much again as the width of the ocellar tubercle; front broader, the fine striae replaced by rugae; facial protuberance not divided longitudinally; abdomen two and a half to three times as long as the thorax, segments two and three mainly reddish, the silvery pollen is absent; cross-bands of wing considerably darker in colour and the two nearest to the base coalesce slightly medianly; the legs are of a darker red; genital spines red.

Holotype: Male, taken at Blackheath, New South Wales (by G. H. Hardy) and is in his collection, Brisbane.

Allotype: Female, from Bribie Island, Queensland (H. Hacker), in the Queensland Museum, No. 3494.

Habitat: New South Wales, Sydney (G. H. Hardy, 1 ♀, December, 1918); Manly (2 ♀, November, 1923); Blackheath (2 ♂, G. H. Hardy, November, 1919); Queensland, Tambourine Mountain (1 ♀, H. Hacker, November; 3 ♀, J. Mann, December, 1925); Bribie Island (1 ♀, H. Hacker, September, 1918).

This species is provisionally placed as an *Acupalpa*. I am reluctant to form new genera at the present juncture owing to the lack of material from which to draw conclusions. The style in *semirufa* is definitely two segmented, whereas that of *rostrata* (the genotype) is composed of one segment. When dealing with group 1 of part 1 of these studies (Aust. Zoologist, vol. 5, part 2, 1928) I formed the opinion that the style afforded excellent characters for generic segregation, but since working over this second group I am convinced that the validity of certain characters as generic criteria depends entirely on the particular group. Whereas, the two-segmented style in 1 would indicate a separate genus from a species with same composed of one segment only; in 2 the indications may not necessarily be such. With this in view I have decided to place the present species in *Acupalpa* for the time being. It can readily be distinguished by the colour of the abdomen.

*ACUPALPA SEMIFLAVA* sp. nov.

Length: 6-9 mm.

*Female*: Head with the occiput slightly concave, black; eyes separated on the vertex by almost as much again as the width of the ocellar tubercle and from thence diverging with the anterior margins practically straight; ocellar tubercle black; ocelli brown; front black, sparsely pubescent, orna-



mented with a few indistinct, longitudinal striae; antennal tubercle bilobate, shining black; antennae black, segment 1 almost two-thirds the length of 3; 2 one-third the length of 1; 3 slightly longer than 1 and 2 united, somewhat conical and slightly broader than the other segments; style received into the apical hollow of the last antennal segment; the arista is rather thick at the base and is about two-thirds the length of the style; face shining black, bare except for fringe of stiff black hairs, protruding bulbous-like almost as far forward as the antennal tubercle; cheeks black, becoming silver-grey as they descend under the eyes, with black and whitish hairs; proboscis brown-black and black haired; palpi brown-black and beset with long black hair, two-thirds the length of the proboscis.

Thorax one and one half times as long as and about as deep as broad, two and one half times as long as the head; dull black; ornamented with 3 indistinct grey parallel stripes; furnished with a few black bristles which appear to vary individually and clothed with black pubescence; pleurae black, grey tomentose; scutellum velvet-black furnished with 2 strong and 2 weak bristles; postscutellum brown-black.

Abdomen three times as long as, and, at its broadest point as broad as the thorax, tapering; segments 1-3 yellow and the remainder black; the whole clothed with black pubescence; venter similar; genital spines reddish.

Legs black-brown; knees and first tarsal segments of the middle and hind legs pale-brown; the 2 anterior basal tarsal segments white.

Wings hyaline with tip and two crossbands dark grey, the first of these bands is narrow and crosses at the apices of the basal cells and the other crosses the median cell and is as broad as that cell is long; cell M3 hardly as broad as, but slightly longer than the median.

The halteres are brown with pale yellow apices.

The male is unknown.

Holotype: Female, Brisbane (H. Hacker, September, 1914), is in the Queensland Museum, No. 3495, together with paratypes; and further paratypes in G. H. Hardy's and the author's collection, Brisbane.

Habitat: Queensland, Brisbane (4 ♀, September, 1912; 1 ♀, October, 1913; 4 ♀, September, 1914; and 1 ♀, October, 1916, H. Hacker; 1 ♀, G. H. Hardy, October, 1926).

The species can readily be distinguished by the colour of the abdomen.

#### Genus AGAPOPHYTUS.

*Agapophytus* Guerin, Voy. Coq. Zool., T., 1, pt. 2, p. 289, 1830; *Id.*, Krober, Ent. Mitt., 1, p. 283, 1912; *Phycus* White, Proc. Roy. Soc. Tasm., 1915.

Moderate to large species with the head subhemispherical or transverse, distinctly, or twice as broad as long and slightly broader than the thorax; occiput deeply concave and fringed with black hairs and bristles; eyes bare, large and descending well down on to the cheeks, facets uniform, separated in both sexes, but slightly more so in the female than in the male; ocellar tubercle large, oval, distinctly raised and provided with tufts of black hair or else bare; ocelli three in number; front convex, bare and smooth or slightly sculptured and sometimes haired; antennal tubercle slightly raised and sometimes bilobate; antennae, in relation to the anterior margin of the eyes are inserted at about half its depth, they are considerably longer than the head with segment 1 considerably or slightly longer than the head (except in *imitans*) and this segment is cylindrical and parallel sided, segment 2 is somewhat rectangular and 3 is irregularly elongate-conical and sometimes somewhat compressed towards the apex; the two basal segments bear

numerous black hairs and bristles or are haired only; style one-segmented (composed of 2 segments in *ruficaudus* and *aterrimus*); face and cheeks small, the latter bearing long fine hair; proboscis stout and projecting slightly; palpi two-segmented.

Thorax convex above, haired and provided with 3-5 pre-alar, 1-2 inter-alar, 1-4 post-alar and 2-4 pre-scutellar bristles and may also bear scales; scutellum semicircular and provided with 0-2 marginal bristles and, or, a marginal tuft of hairs; postscutellum large and convex and well hidden beneath the scutellum.

Abdomen slightly longer but narrower than the thorax, cylindrical but slightly flattened above; haired; genitalia retracted.

Legs of normal length, the tibiae and tarsi bearing numerous bristles but the femora are devoid of such.

Wings banded and comparatively broad; veins M3 and M4 similarly with Cu1 and 1A coalesce well before or slightly before the wing border; cell M3 may be longer and narrower than the median or else longer and broader than that cell; costa and hind margin ciliated.

The sexes are similar showing a slight variation in colour only and the individuals of any species vary slightly. The group is very homogeneous and the species are closely allied.

Genotype: *Agapophytus australasiae* Guerin.

Range: Australia only; one species (*A. distinctus*) from an unknown locality was described by Walker and this is possibly Australian. It has not been recognised.

Distribution: The typical species is known from New South Wales and Queensland, *flavicornis*, *albobasalis*, *ruficaudus* and *squamosus* from Queensland only; *aterrimus* extends from Victoria through New South Wales to Queensland, while *varipennis* is known from New South Wales only and *quatiens* from Tasmania only. White's *imitans* has been found on Tambourine Mount (2,000 ft.) Queensland, in addition to the type locality in Tasmania, but *albopunctatus*, which was described from South Australia, is not known to me outside of Victoria.

Synonymy: Guerin-Meneville, in Duperrey, Voy. "Coquille" (Atlas, Ins., pl. xi., fig. 15) used the name *Agapophyta bipunctata* for a genus and species of HEMIPTERA in 1827-30 and published the description of the genus in 1838 (Zool., ii., (2), 1, p. 168) and in the same publications he first figured *Agapophytus australasiae* and then described the genus in the latter work on page 289. In consequence of this the question of regarding the name *Agapophytus* as being preoccupied in HEMIPTERA by page precedence has arisen. I am indebted to Mr. A. Musgrave of the Australian Museum for drawing my attention to the above references.

I have decided to leave the name unchanged, because the difference in the ending of the two names is sufficient to distinguish them in the eyes of the International Code. It is true that many do not agree with this particular law, but it seems that one is in the position of a judge who must administer the law as he finds it, and who can only have it altered by the legislature. The recent international congress did not touch this particular law, although they did alter the Law of Priority.

The law in question is quoted below:—

"Article 34.—A generic name is to be rejected as a homonym when it has previously been used for some other genus of animals. *Rec.* It is well to avoid the introduction of new generic names which differ from the generic name already in use only in termination or in a slight variation in spelling which might lead to confusion. But when once introduced, such names are

not to be rejected on this account. Example. *Picus*, *Pica*, are valid but undesirable."

White's interpretation of the genus *Phycus* has been placed as a synonym of *Agapophytus*; an examination of this author's species and a series of *Agapophytus* did not reveal any structural differences of sufficient importance to justify the separation of the two. There is a complete gradation of the characters given by White between the two genera and one is not able in many cases to decide to which genus a particular insect should be referred. It is not possible for me to decide whether *Phycus* is a synonym of *Agapophytus* or not as the former was originally described from India and is known from South Europe, Asia, Africa and South America also. The group may be quite a definite conception in these countries and White's identification of same just the opposite. Both Schiner and Kroker described the genus from Australia, but their species have not been recognised. In view of the latter worker's knowledge of the world's genera my belief that it may occur in this country is strengthened, but White's species certainly cannot be separated from the Australian genus.

*Key to the Species of Agapophytus Guerin.*

1. Antennae and anterior tarsi wholly yellow; wings tinged grey with a broad dark grey cross band. . . . . *flavicornis* sp. nov.  
Antennae at most with first two segments yellow. . . . . 2.
2. All femora mainly black, the tip of the anterior femora only may be otherwise coloured. . . . . 3.  
Femora coloured otherwise. . . . . 6.
3. Anterior tibiae wholly yellow and remaining tibiae black; wings tinged grey with a dark grey cross band. . . . . *australasiae* Guerin.  
Anterior and middle tibiae wholly yellow and remaining tibiae black; wings grey with two yellow cross bands. . . . . *albopunctatus* Roder.  
Anterior tibiae mainly black; they may be otherwise coloured at the apices. . . . . 4.
4. Abdomen with apical segments wholly black. . . . . 5.  
Abdomen with segments 4-7 ferrugineous. . . . . *ruficaudus* sp. nov.
5. Thorax densely covered with white scales; legs wholly black except for apices of anterior tibiae which are dirty white; wings smoky with two broad yellow cross bands. . . . . *aterrimus* sp. nov.  
Thorax without scales; legs black, the whole of the first anterior tarsal segments except for the tip cream coloured and the basal two-thirds of the first tarsal segments of the middle and hind legs are yellowish white; abdomen with the first segment white. . . . . *albobasalis* sp. nov.
6. Wings grey with a broad yellow cross band; thorax with whitish scales; legs mainly red. . . . . *squamosus* sp. nov.  
Wings mottled grey or at most with irregular grey cross bands; thorax without scales; legs coloured otherwise. . . . . 7.
7. Tarsi black except for the hind ones which are dark brown; hind tibiae dark brown except for the extreme apices, which together with the rest of the legs, are bright brown. . . . . *varipennis* sp. nov.  
Not such. . . . . 8.
8. Legs dark orange, apical half of fore and extreme apices of hind tibiae and basal half of the first anterior tarsal segments black; remainder of anterior tarsi pale yellow; middle tarsi brown. . . . . *imitans* White.  
Legs orange except for the black apical tarsal segments of all legs. . . . .  
. . . . . *quatiens* White.

In the material before me I have numbers of new species, but all are represented by single or damaged specimens, so I am refraining from describing these until more are available.



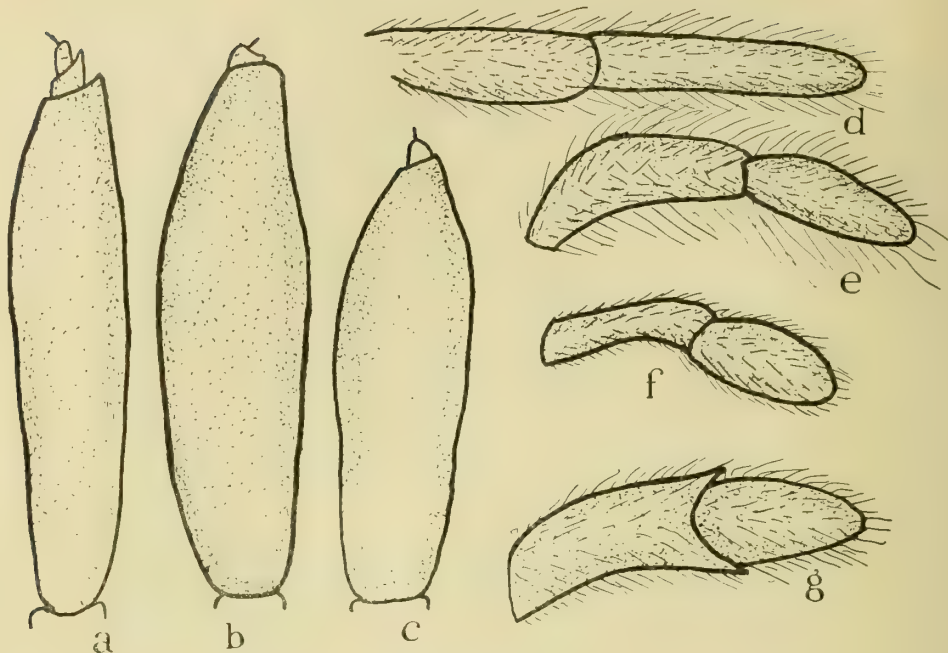


Fig. 4.

- a. third antennal segment of *Agapophytus ruficaudus* sp. nov.
- b. third antennal segment of *Agapophytus squamosus* sp. nov.
- c. third antennal segment of *Agapophytus varipennis* sp. nov.
- d. palp of *Agapophytus flavicornis* sp. nov.
- e. palp of *Agapophytus australasiae* Guerin.
- f. palp of *Agapophytus quatiens* White.
- g. palp of *Agapophytus varipennis* sp. nov.

*AGAPOPHYTUS FLAVICORNIS* sp. nov.

Length: 12-15 mm. (including antennae).

*Male*: Head distinctly broader than long, slightly broader than the thorax; occiput black, eye margins fringed grey; eyes separated on the vertex by slightly more than the width of the ocellar tubercle and from thence widely diverging with the anterior margins practically straight; ocellar tubercle bare, prominently raised and brown; ocelli orange; front bare, dark yellow with some orange reflections and mostly orange on the vertex; antennal tubercle yellow; antennae 4-5 mm. long, wholly yellow, at least three times as long as the head, segment 1 black haired with a few bristles at the apex only, as long 2, 3 and style united; 2 one-sixth the length of 1 and bearing numbers of black hairs and bristles; 3, slightly compressed towards the apex, very slightly broader than the other segments and slightly more than two-thirds the length of 1, sparsely black haired; style one-third the length of the second antennal segment; arista black and

half the length of the style; face bare, yellow with some whitish tomentum towards the sides; cheeks orange brown, becoming grey under the eyes and bearing black and brown hairs; proboscis brown-black, sparsely black and brown haired and projecting as far forward as one-third the length of the first antennal segment; palpi filiform the basal segment being rather stouter than the apical but of about the same length, brown and rather densely long brown haired, especially on the basal segment, they are about two-thirds the length of the proboscis.

Thorax slightly more than half the length of the abdomen, hardly more than twice as long as its greatest width, almost as deep as long and about three times as long as the head; dull black; clothed with black and white pubescence; ornamented on either side with an obliquely set brown and rather broad stripe which extends from the wing base for one-third the distance to the head, there is a trace of a median transverse similarly coloured stripe also; furnished with 4 rather strong black pre-alar bristles; pleurae dull black, covered with grey tomentum; scutellum dull black and furnished with two short black bristles; postscutellum dull black.

Abdomen hardly twice the length of the thorax; dull black clothed with black and white pubescence; segments 2-3 show traces of a brown dorsal area near to the anterior margins; venter similarly coloured and clothed; genitalia brown.

Legs dull black, anterior femora with sides and the underside and apical third dark brown; remainder of anterior legs, including tarsi, yellow with a somewhat greenish reflection; the coxae bear a few black bristles and some tufts of whitish hair.

Wings tinged grey with a rather broad dark grey cross band extending in width from the base of the median cell to just prior to the wing tip; venation as in *australasiae*.

The female differs from the male by having the eyes very slightly more widely separated on the vertex, the front mostly orange, some brown reflections on the thorax and abdomen, less brown on the anterior femora and by the absence of the olive reflections on the anterior tibiae and tarsi.

Variations: The colour of the anterior tibiae and tarsi varies from orange-yellow to yellow, and the olive reflections may be present or absent in either sex. The front in both sexes varies between yellow and orange.

There are two males from West Australia, Harvey (L. J. Newman, January) before me, which may represent a distinct species; they differ from the typical form as follows:—

Front black on the upper half, lower half orange; segments 2 and 3 of the antennae are black; cheeks black; proboscis and palpi black; segment 2 of the abdomen apically margined grey; wings except for the hyaline tip dark grey.

There is a further female from South Queensland, Goondiwindi (F. H. Roberts, December, 1927) which differs again as follows:—

Front black covered with grey tomentum; ocellar tubercle black, ocelli clear; antennal tubercle rather prominent and orange; antennae yellow with segment 2 and the basal fourth of 3 grey-brown; face mostly silvery grey tomentose; cheeks black; proboscis and palpi black; thorax and abdomen with patches of brown and clothed with considerably more grey tomentum; anterior femora except for the orange apical fourth, wholly black; the cross band of the wing rather more black than dark grey.

*A. flavicornis* is distinguished from *australasiae* by the wholly yellow antennae and anterior tarsi, by the wholly black intermediate and posterior tarsi and by the wings having one cross band only.

A Hymenopterous-like Therevid, which is generally found running up

and down the trunks of trees, particularly *Eucalyptus*; dead or burned stumps appear to attract the species also.

Holotype: Male, Brisbane, Queensland (H. Hacker, October, 1921) and allotype, female, Ferny Grove, Queensland (J. Mann, January, 1928), both in Queensland Museum, No. 3496, together with 11 male paratypes, No. 3497. Further paratypes in G. H. Hardy's and the author's collection, Brisbane.

Habitat: Queensland, Brisbane (1 ♂, 5 ♀, November-January, 1922-26, G. H. Hardy; 10 ♂, November-January, 1912-16, H. Hacker); Ormiston (1 ♂, November, 1924, H. Hacker); Westwood (2 ♂, October, 1923, A. N. Burns); Chinchilla (1 ♂, G. R. Bassingthwaighte, November, 1926).

#### AGAOPHYTUS AUSTRALASIAE.

*Agapophytus australasiae* Guerin, Voy.-Coq. Zool., p. 290, 1838; *Id.*, Roder, Berl. Ent. Zeitz., xxix., p. 138, 1885; *Id.*, Kroker, Ent. Mitt., 1, p. 234, 1912; *Agapophytus pyrrhotelus* Walker, List. Dipt. Brit. Mus., 5, suppl. 1, p. 321, 1854.

Length: 11-15 mm. (including antennae).

*Male*: Head slightly wider than the thorax and distinctly broader than long; occiput black, yellow along the eye margins; eyes separated on the vertex by as much again as the width of the ocellar tubercle, concavely diverging below this; ocellar tubercle bare, and dull black; ocelli yellowish; front bare or at most tomentose only, dull black with a deep and broad transverse furrow; antennae 3-4 mm. in length at least three times as long as the head, segment 1 brown and is one and one half times as long as the head, slightly less than the length of 2 and 3 united; 2 and 3 black the former being one-eighth the length of 1 and the latter being somewhat compressed toward the apex; style black and one-fourth the length of the second antennal segment; arista black and one-third the length of the style; face bare, dull black, grey tomentose; cheeks black and bearing black hair; proboscis black and projecting as far forward as half the length of the first antennal segment; palpi filiform, very hairy and the basal segment is slightly longer and broader than the apical, both of which are black.

Thorax half the length of the abdomen, hardly more than twice as long as its greatest width and almost as deep as long; dull black covered with grey tomentum and hairs and ornamented with an obliquely set brown stripe on each side which join a dorsal transverse one of the same colour, thus forming an arch extending from the base of one wing to the other; there is also an oblique furrow on each side extending from the wing base for one-third the distance to the head; furnished with 2 strong and 3 weak prealar bristles; scutellum black-brown and devoid of marginal bristles; post-scutellum similarly coloured; pleurae black.

Abdomen about as broad as the thorax, somewhat flattened on the sides and slightly tapering; dull black, covered sparsely with white and black hairs; venter dull black; genitalia pale brown.

Legs elongate, posterior femora flattened on the sides, first anterior tarsal segments somewhat dilated, the anterior coxae bear a few bristles and tufts of hair; black; apices of anterior femora and apices of the first posterior tarsal segments orange-brown; anterior tibiae, two basal segments of anterior tarsi and bases of first intermediate tarsal segments yellow.

Wings tinged grey with a broad, dark grey, cross band extending from near the base to the apex of the median cell and another narrow one crossing at the tip of the wing; R4 straight except for a slight upward curve near the extremity; M1 and M2 slightly sinuous; M3 and M4 meet each other slightly before the margin; Cul coalesces with 1A, which is straight,



well before the wing border; cell M3 slightly longer and broader than the median. The halteres are black.

The female of this species is unknown to me.

Variations: The anterior tibiae grade in colour from orange to yellow.

There is a specimen in the material before me which differs slightly from the typical ones: The face is grey becoming black towards the cheeks which are black for a short distance and then grey; the wings are hyaline, except for a narrow dark grey band crossing the median cell; cell M3 is longer but hardly broader than the median.

The species has habits similar to those of *A. flavicornis* and is found under the same circumstances.

Habitat: Queensland, Eidsvold (1 ♂, December, 1922); Stradbroke Island (2 ♂, F. H. Roberts, October, 1926); Gordonvale (3 ♂, F. P. Dodd, February, 1919, and January, 1926).

Separated from all other *Agapophytus* by having the anterior tibiae wholly yellow and the remaining tibiae black.

#### AGAPOPHYTUS ALBOPUNCTATUS.

*Agapophytus albopunctatus* Roder, Berl. Ent. Zeitz., xxix., p. 139, pl. 4, figs. 1-3, 1885; *Id.*, Krober, Ent. Mitt., 1, p. 120 and p. 283, 1912.

Length: 12-14 mm. (including antennae).

*Male*: Head transverse twice as broad as long; occiput shining black; eyes separated on the vertex by the width of the ocellar tubercle, and with the anterior margins parallel for a short distance below this and from thence convex and diverging; ocellar tubercle, bare and shining black; ocelli dark brown; front shining black, bare and smooth; antennae 4 mm. long, three times as long as the head, black with the basal sixth of the first segment brown; segment 1 almost seven times as long as 2 which is one-sixth the length of 3; 3 is broader than the other segments toward the tip and is slightly shorter than 1; style about one-sixth the length of the second antennal segment; arista one-third the length of the style; face and cheeks black, grey tomentose and the latter bearing greyish hair; proboscis and palpi brown-black, the former projecting as far forward as one-third the length of the first antennal segment and the latter about two-thirds the length of the former and with both segments of about the same length, but the apical is somewhat stouter.

Thorax somewhat longer and deeper than broad, almost three times as long as the head; dull black with brown reflections dorso-anteriorly; furnished with black and greyish hairs and a few white scales, 4 pre-alar, 1 inter-alar, 2 post-alar and 4 pre-scutellar bristles; pleurae black, grey tomentose; scutellum and postscutellum dull black, the former provided with 2 bristles.

Abdomen black; segment 1 somewhat brown; 2 and 3 apically margined white; the whole black and grey haired; venter black; genitalia brown.

Legs orange, coxae, femora and basal four-fifths of the hind tibiae black.

Wings dark grey with two broad yellow cross bands, the first of which extends from the base to near the tips of the basal cells and the other from the apex of the median to half the length of R4; venation normal; cell M3 slightly narrower and longer than the median.

The halteres are pale brown.

The female is unknown to me.

Habitat: Victoria, Warburton (1 ♂, F. E. Wilson, January, 1924).

Krober described his specimen from Adelaide.

The species is readily distinguished by the colour of the legs and wings.

*AGAPOPHTYUS RUFICAUDUS sp. nov.*

Length: 10-12 mm. (including antennae).

*Male:* Head transverse, considerably broader than the thorax and at least twice as broad as long; occiput black with patches of grey in the middle and towards the sides, and with greyish hairs on the sides; eyes separated on the vertex by the width of the ocellar tubercle, the anterior margins straight and very slightly diverging until level with the antennae from whence they convexly diverge; ocellar tubercle very large, somewhat triangular, considerably raised and provided with rather long pubescence; ocelli brown; front black and bearing long whitish hair; antennal tubercle small and flattened, shining black, antennae 3 mm. long, at least twice as long as the head, black with the basal third of the first segment brown and with some brown reflections towards the apex of this same segment; segment 1 bears some black bristles at the apex only; as long as the head, seven times as long as 2 which is one-seventh the length of 3; 3 compressed at the apex and about the same length as 1; style two-segmented hardly as long as the second antennal segment and having its basal segment slightly shorter than, but about twice as broad as, its apical which is somewhat tholiform; arista one-fifth the length of the style; face evenly convex, black, bare; cheeks dull black provided with black and grey hair; proboscis and palpi black, the latter provided with long black hair with the apical segments somewhat spatulate.

Thorax slightly more than twice as long as the head, hardly twice as long as, and about as deep as broad; dull black, greyish tomentose and ornamented with a broad convex brown transverse band which arises and terminates at the bases of the wings; furnished with 2 pre-alar, 2 inter-alar and 1 post-alar bristles; pleurae black, grey tomentose; scutellum brown-black, furnished with a large dense marginal tuft of black bristles; post-scutellum black with silver-grey reflections.

Abdomen black, greyish anteriorly and laterally; segments 4-7 ferruginous; the whole covered with black and brown pubescence; genitalia brown; venter similarly coloured as the dorsum except that there is more black on that of segments 4-7.

Legs black, all the first basal tarsal segments dirty white; wings smoky with a broad pale yellow cross band extending from the apex of the median cell to one half the length of R<sub>4</sub>; M<sub>3</sub> and M<sub>4</sub> similarly with Cu<sub>1</sub> and 1A coalesce well before the wing border, the latter vein being very slightly sinuous; cell M<sub>3</sub> is longer and broader than the median. The halteres are brown with yellow apices. The female differs from the male in having the eyes slightly more widely separated on the vertex, a broader front which is less hairy and a more elongate abdomen.

Variations: The density of the wing coloration may vary.

Holotype: Male, Samford Range, Queensland, January, 1923; and Allotype, female, Brisbane, February, 1925 (H. Hacker), in the Queensland Museum, No. 3498.

Paratypes (4 ♂, Brisbane, September, 1923, H. Hacker), in the Queensland Museum, No. 3499.

Habitat: As above.

The species is diverse from the more typical forms in having the transverse head, two-segmented style, spatulate palpi and the large dense tuft of bristles on the scutellum. It can readily be recognised by the colour of the abdomen, wings and legs.

*AGAPOPHTYUS ATERRIMUS sp. nov.*

Length: 10-14 mm. (including antennae).

*Male:* Head transverse (but not nearly so as in *ruficaudus*), twice as broad as long; occiput black; eyes separated on the vertex by the width of

the ocellar tubercle and with the anterior margins straight and parallel for one-third the length of the frons and from thence widely diverging; ocellar tubercle very large, raised considerably, somewhat triangular and provided with dense long black and whitish hair; ocelli black-brown; front shining black, bare; antennal tubercle small, very slightly projecting, shining black; antennae 3 mm. long, slightly more than twice as long as the head, black with the basal fourth of the first segment brown, the whole be-haired; segment 1 eight times as long as 2 which is one-sixth the length of 3; segment 3 somewhat broader towards the apex and at its broadest point slightly broader than the other segments; slightly compressed near the apex and slightly shorter than 1; style two-segmented, the basal being broader but considerably shorter than the apical which is tholiform; arista short and thick, being about one-fifth the length of the style; face and cheeks black, the former covered with long whitish and black hair, the latter becoming grey under the eyes and bearing whitish hair; proboscis and palpi black, black haired, the former projecting as far forward as two-thirds the length of the first antennal segment and the latter with the basal segment slightly longer than the apical.

Thorax slightly more than twice as long as head, one and one half times as long as and about as deep as broad; deep black with white scales, black haired and furnished with 4 pre-alar and 1 inter-alar bristles; pleurae black, grey tomentose; scutellum and postscutellum black, the former provided with 2 bristles.

Abdomen one and one half times as long as the thorax; black, segments 1-3 silvery pollinose, 1 with some brown reflections and 2 with a brown median patch on the posterior margin; the whole black and white haired; venter black; genitalia light brown.

Legs black, the apices of the fore tibiae dirty white.

Wings smoky with two broad yellow cross bands, the first of which extends from the base almost to the apices of the basal cells and the second from the apex of the median to half the length of vein R<sub>4</sub>; venation as in *ruficaudus* except that cell M<sub>3</sub> is slightly narrower and longer than the median. The halteres are yellow.

The female differs from the male in having the eyes separated on the vertex by slightly more than the width of the ocellar tubercle, with the anterior margin slightly concave, the broader front, the more elongate abdomen which is devoid of silvery pollen but the second segment is apically margined white.

Holotype: Male, Brisbane, Queensland (October, 1916, H. Hacker) in the Queensland Museum, No. 3500. Allotype: Female, Sydney, New South Wales (January, 1924, I. M. Mackerras) and in his collection, together with a paratype male.

A further paratype female in the writer's collection, Brisbane, Queensland.

Habitat: Queensland, Brisbane (as above); New South Wales, Toronto (1 ♀, no date); Sydney (as above); Victoria, Mooroopna (1 ♂, December, 1923, F. E. Wilson).

*AGAPOPHYTUS ALBOBASALIS* sp. nov.

Length: 11-13 mm. (including antennae).

*Male*: Head distinctly broader than long; occiput shining black, somewhat greyish towards the eye margins; eyes separated on the vertex by the width of the ocellar tubercle, converging slightly below this and then diverging with the anterior margins slightly concave; ocellar tubercle bare and shining black; ocelli brown; front bare and shining black; antennal tubercle bilobate bare and shining black; antennae 3-4 mm. long, three



times as long as the head, black with the basal half of the first segment brown, all segments haired but devoid of bristles; segment 1 slightly more than six times as long as 2 and almost as long as 2 and 3 united; 2 one-sixth the length of 3 which is somewhat compressed towards the apex and very little broader than the other segments; style broadly conical and one-third the length of the second antennal segment; arista stout and slightly shorter than the style; face slightly convex on the upper half, sparsely pubescent and shining black; cheeks dull black, becoming grey under the eyes and bearing greyish hair; proboscis brown-black, black haired and projecting as far forward as two-thirds the length of the first antennal segment; palpi somewhat sharp pointed, black and having the basal segment rather stouter but of about the same length as the apical, black haired.

Thorax two and one-third times as long as the head, about two-thirds as long as its greatest width and slightly deeper than broad; brown-black with brownish patches on the anterior margin and along the sides; ornamented with faint indications of two brown parallel dorsal stripes extending from the anterior margin for one-fourth the length of the dorsal surface; furnished with 4 pre-alar 2 inter-alar, 2 post-alar and 2 pre-alar bristles, all of which are black and fairly stoutly developed; the whole thorax is furnished rather densely with black pubescence; pleurae black, grey tomentose; scutellum brown-black and armed with two bristles; post-scutellum black-brown.

Abdomen twice as long as and about as broad as the thorax; brown-black with segment 1 wholly greyish white and 2 and 3 apically margined white; covered with black and some greyish pubescence; venter similar; genitalia brown.

Legs black; the whole of the first anterior tarsal segments, except for the tips are cream coloured; the basal two-thirds of the first tarsal segments of the intermediate and posterior legs, yellowish white.

Wings dark smoky with two broad yellow cross bands, the first of which crosses at the base and extends for half the length of the basal cells and the second crosses at the apex of the median cell and extends slightly beyond the fork of R4 and R5; venation as in *ruficaudus*. The halteres are yellowish, slightly black at the base.

The female differs from the male in having the anterior margin of the eyes straight and diverging for the whole of its length and in having the front slightly concave. The genital spines are black.

Variations: Two male specimens from New South Wales differ from the Queensland forms in having rather more brown and more distinct stripes on the thorax and fainter wing bands.

Holotype male and Allotype female, Chinchilla, Queensland (A. P. Dodd, November, 1927) both in the Queensland Museum, No. 3501, together with 4 female paratypes, No. 3502. A further 2 male paratypes in A. J. Nicholson's collection at Sydney and a pair in the author's collection, Brisbane.

Habitat: Queensland, Chinchilla (1 ♂, 1 ♀, A. P. Dodd); Brisbane (2 ♀, November, 1911, and April, 1919); National Park (1 ♀, December, 1919); Stradbroke Island (1 ♀, December, 1912); all taken by H. Hacker, Westwood (1 ♂, November, 1927, A. P. Dodd); New South Wales, Mittagong (2 ♂, January, 1924, A. J. Nicholson); South Australia, Murray River (1 ♀, F. R. Zietz).

The species is readily recognised by the colour of the legs and wings and by the white basal abdominal segment. It has been taken visiting Wilga flowers.

*AGAPOPHYTUS SQUAMOSUS sp. nov.*

Length: 11-13 mm. (including antennae).

*Male:* Head transverse, two and one-half times as broad as long; occiput black, brown and black haired; eyes separated on the vertex by the width of the ocellar tubercle, the anterior margins parallel for a short distance below this and from thence convexly diverging; ocellar tubercle black; ocelli almost black; front shining black and bare; antennal tubercle, small, very slightly raised, black but somewhat brownish apically; antennae 3 mm. long, slightly more than twice as long as the head, black with the basal half of segment 1 light brown which gradually deepens to dark brown towards the apex, where it is black and this segment is eight times as long as 2 which is hollowed apically; 3 broader towards the apex and at this part is broader than the other segments, compressed apically and slightly shorter than 1; style half the length of the second antennal segment; arista one-fourth the length of the style; face and cheeks black, the former tomentose and the latter bearing greyish hair; proboscis black-brown and projecting as far forward as half the length of the first antennal segment; palpi black, half the length of the proboscis and densely long black haired and with the apical segment broader but of the same length as the basal.

Thorax almost twice as long as the head, one and one half times as long as and about as deep as broad; black, covered with numerous dirty white scales and black hairs; furnished with 4 pre-alar, 1 inter-alar, 1 post-alar and 4 pre-scutellar bristles, all of which are black; pleurae, scutellum and postscutellum black, the former grey tomentose and the scutellum bearing 2 bristles.

Abdomen black; segment 1 brown; 1-3 apically margined white; the whole black and white haired; venter black; genitalia light brown.

Legs red; coxae black; apices of tarsi dark brown.

Wings as in *aterrimus*.

The female differs from the male in the usual sexual characters only. The genital spines are black.

Variations: The four apical tarsal segments may be wholly black. One male from Clermont, Queensland, has the femora wholly black and three others have black stripes on the femora and brownish on the tibiae.

Holotype male and Allotype female, Brisbane, December, 1924, *in copula*.

Collected by H. Hacker and in the Queensland Museum, No. 3503. Paratypes in the author's collection, Brisbane.

Habitat: Queensland, Brisbane, as above, Clermont (4 males, no date given); Chinchilla (1 pair, November, 1926, B. A. Smith, and 1 pair G. R. Bassingthwaighe, December, 1926).

Distinguished by the thoracic scales and the colour of the wings and legs.

*AGAPOPHYTUS VARIPENNIS sp. nov.*

Length: 12-14 mm. (including antennae).

*Male:* Head transverse, twice as broad as long and with the occiput shining black; eyes separated on the vertex by the width of the ocellar tubercle and with the anterior margins slightly converging below this for half the length and from thence more or less straightly diverging; ocelli black-brown; front shining black, sparsely short black haired and somewhat hollowed medianly; antennal tubercle small, very slightly projecting and shining black; antennae 3 mm. long, two and one half times as long as the head, black with the basal fifth of the first segment brown, the whole black haired, those on the two basal segments approaching to short

bristles; segment 1 almost ten times as long as 2 which is one-sixth the length of 3 and this segment is two-thirds the length of 1; style tholiform and one-third the length of the second segment of the antennae; arista fully half the length of the style; face concave, black and grey tomentose; cheeks grey and furnished with grey hair; proboscis black-brown and projecting as far forward as one-fourth the length of the first antennal segment; palpi black and the apical segment is conical and slightly shorter than the basal, the whole is covered densely with long black hair.

Thorax slightly more than twice as long as the head, hardly twice as long as but about as deep as broad; black-brown with grey at the anterior lateral angles and antero-medially; black haired and furnished with 3 pre-alar, 1 inter-alar, 1 post-alar and 2 pre-scutellar bristles; pleurae black, grey tomentose; scutellum brown-black with 2 bristles; postscutellum black.

Abdomen almost twice as long as and as broad as the thorax, somewhat flattened above; black, segment 1 mainly greyish, 2 and 3 with brown tomentum; venter black; genitalia light brown.

Legs bright brown; coxae and fore and middle tarsi, black; hind tibiae except for extreme apices and hind tarsi, dark brown.

Wings mottled dark grey medianly and apically; venation as in *aterrimus*. The halteres are brown, lighter apically and nearly black near the base.

The female differs from the male only in having the eyes separated on the vertex by twice the width of the ocellar tubercle.

Variations: There may be more brown and less grey in the thoracic coloration.

Holotype male and Allotype female, Toronto, New South Wales, taken *in copula*, and in Dr. I. M. Mackerras' collection, Sydney. A female paratype in Dr. A. J. Nicholson's collection at the Sydney University and in the writer's collection, Brisbane.

Habitat: New South Wales, Toronto (as above; no date given); Barrington Tops (1 ♀, January, 1925. S.U. Zool. Exp.); Mittagong (1 ♀, January, 1924. A. J. Nicholson).

Readily recognised by the wing pattern and leg coloration.

#### AGAOPHYTUS IMITANS.

*Phycus imitans* White, Proc. Roy. Soc. Tasm., 1915.

Length: 9-10 mm. (including antennae).

*Male*: Head subhemispherical, somewhat flattened above, almost twice as broad as long; occiput black; eyes separated on the vertex by the width of the ocellar tubercle and from thence converging for half the distance to the antennae and then convexly diverging; ocellar tubercle bare and black; ocelli brown; front narrow, shining black, smooth and bare; antennal tubercle projecting slightly, bare, shining black with some white reflections on the sides; antennae brown with the base and tip of the apical segment black; segment 1 slightly less than half the length of the head and seven times as long as 2; 3 slightly longer than 1 and very slightly broader; style very short; arista twice the length of the style; face convex above, concave below, black with grey tomentum; cheeks grey and bearing grey hair; proboscis brown and projecting as far forward as two-thirds the length of the antennae; palpi brown and somewhat sharp pointed.

Thorax one and one half times as long as the head; black with a brown longitudinal median stripe and somewhat grey on the humeral calli; furnished with black pubescence and 4 pre-alar, 1 inter-alar, 1 post-alar and 4 pre-scutellar bristles; pleurae black, grey tomentose; scutellum velvet black and armed with 2 bristles; postscutellum grey-black.



Abdomen twice as long as and slightly narrower than the thorax; black; segments 2-3 apically margined white; venter black; genitalia brown.

Legs dark orange; coxae, apical half of fore and extreme apices of hind tibiae and basal half of first anterior tarsal segments black; remainder of anterior tarsi pale yellow; intermediate tarsi brown.

Wings hyaline with the tip and two broad irregular cross bands grey; these bands are confluent in parts and extend from the base to the apex of the median cell; venation normal. Halteres pale yellow. The female differs from the male in having the eyes separated on the vertex by slightly more than the width of the ocellar tubercle and the anterior margins practically straight and uniformly diverging; segments 7 and 8 of the abdomen are brown. The genital spines are red.

Habitat: Queensland, Tambourine Mount (2,000 ft.) (1 ♀, H. Hacker, November, 1925, and Allotype male, J. Mann, December, 1925).

White described the species from a female taken at Wedge Bay, Tasmania, by G. H. Hardy, January, 1914, and his type is in G. H. Hardy's collection, Brisbane.

The male Allotype described here is in the Queensland Museum, No. 3504.

The species is recognised by the colour of the legs.

#### AGAPOPHYTUS QUATIENS.

*Phycus quatiens* White, Proc. Roy. Soc. Tasm., 1915.

Length: 9-12 mm. (including antennae).

*Male:* Head subhemispherical hardly twice as broad as long; occiput black; eyes separated on the vertex by the width of the ocellar tubercle with the anterior margins straight and very slightly converging below this for a short distance and from thence somewhat concave and widely diverging; ocellar tubercle black; ocelli brown; front shining black, bare and smooth; antennal tubercle black, smooth and very slightly projecting; antennae black with the basal fifth of the first segment brown and this segment is seven times as long as 2; segment 3 is missing in the specimen before me but White states that it is half the length of and considerably broader than 1 and "somewhat inflated"; face and cheeks black, the latter with grey hair; proboscis black-brown and projecting as far forward as one-third the length of the first antennal segment; palpi black-brown and two-thirds the length of the proboscis, with the apical segment broader but about the same length as the basal.

Thorax one and one half times as long as broad, black with indications of three brown longitudinal stripes, and brown reflections dorso-centrally and greyish anteriorly and posteriorly; furnished with black pubescence and 3 pre-alar, 1 inter-alar, 4 short post-alar and 2 pre-scutellar bristles; pleurae, scutellum and postscutellum black, the former grey tomentose and the scutellum with 2 bristles.

Abdomen twice as long as the thorax and somewhat tapering; black with segments 1-2 apically margined brown and 3 apically margined white, 7 brown; venter black; genitalia brown.

Legs orange; coxae and apical tarsal segments black.

Wings hyaline with a broad irregular dark grey cross band extending from the middle of the basal cells to the apex of the median, there is also a dark grey patch at the fork of veins R4 and R5; venation normal; cell M3 is slightly longer and narrower than the median. The halteres are yellow.

The female differs from the male in having the eyes separated on the vertex by almost twice the width of the ocellar tubercle and in having the

anterior margins practically straight and diverging for the whole distance.

Habitat: Tasmania, Maria Island (1 ♂, G. H. Hardy, December, 1915); Launceston (1 ♀, G. H. Hardy, January, 1914). White described the type series from Bagdad Valley.

The species is recognised by the colour of the wings and legs.

#### Genus ACATOPYGIA.

*Acatopygia* Krober, Ent. Mitt., 1, p. 149, 1912.

Head broader than long and somewhat pyriform; occiput deeply concave with a median furrow, bristles and hairs present but not numerous; ocellar tubercle large, oval and raised; eyes bare, divided longitudinally by a deep furrow, separated in both sexes but very much more so in the female than in the male, facets uniform; antennal tubercle pronounced; antennae decumbent, shorter than the head and in relation to the anterior margin of the eye are set at about two-thirds its depth, composed of 3 segments, the third of which is broadly conical when viewed in profile and is provided with an apical two segmented style which bears an apical arista; face small, tomentose only; cheeks with long fine hair; proboscis stout and projecting forwards; palpi filiform and about two-thirds the length of the proboscis, composed of two segments, the basal one of which is short, being but one-fifth the length of the apical.

The thorax is hardly as wide as the head, fully twice as long as its greatest breadth, convex above and furnished with but few bristles; scutellum semicircular and bearing 2 marginal bristles; postscutellum convex and well hidden beneath the scutellum.

The abdomen is slightly more than twice as long as the thorax, tapering, flattened dorsally and ventrally, silvery pollinose in the males, hairy, but without bristles; genitalia large and conspicuous in the males; in the female the two apical segments are distended and the genital spines are weak.

The legs are rather elongate, especially the hind pair; the hind femora are somewhat flattened on the sides and they bear a row of bristles on the underside; all tibiae and tarsi are furnished with numerous bristles.

Wings banded; large and broad, in comparison with the size of the insect; vein R4 practically straight; M1 and M2 parallel; M3 and M4 coalesce well before the border and Cu1 coalesces with 1A slightly before the hind margin; cell M broader but not as long as M3; costa and hind margin ciliated.

Genotype: *Acatopygia pulchella* Krober.

Range: Peculiar to Australia.

Distribution: The typical species extends from New South Wales into Southern Queensland.

A monotypical genus easily recognised by the banded wings, large hypopygium, long hind legs, bristled and flattened femora and furrowed eyes.

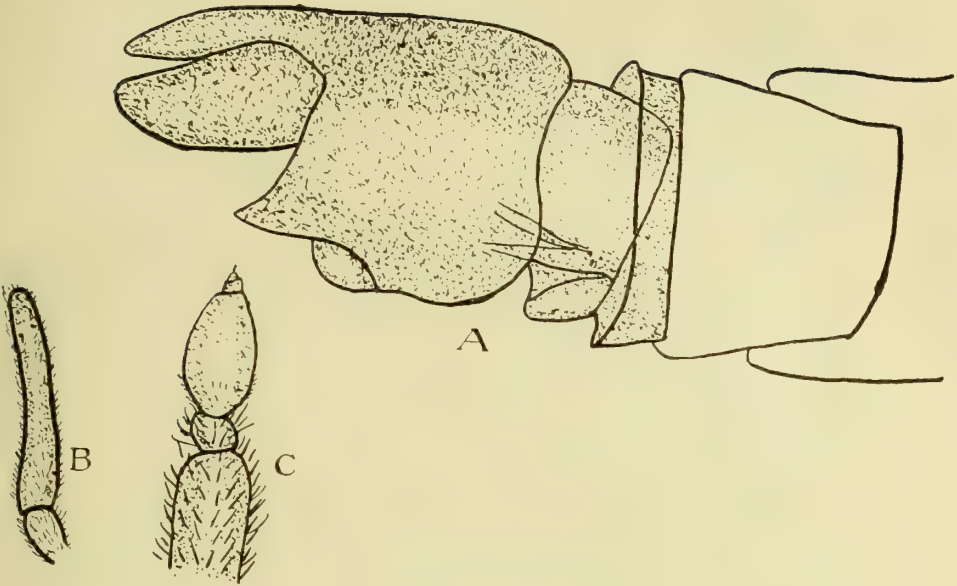


Fig. 5.

*Acatopygia pulchella* Krober.

- A. Extremity of abdomen showing large hypopygium.
- B. Palp.
- C. Antenna.

## ACATOPYGIA PULCHELLA.

*Acatopygia pulchella* Krober, Ent. Mitt., 1, p. 149, 1912.

Length: 7-9 mm.

*Male*: Occiput brown and furnished with a few black bristles; eyes separated on the vertex by the width of the ocellar tubercle, converging slightly below this for half the length and from thence concavely diverging; front dark brown, with some yellowish hairs towards the antennae, but when viewed horizontally the whole is black-brown, covered with long black hairs; antennal tubercle shining black with a white transverse band which is visible from the dorsal aspect only; antennae rather broadly separated at the base with the apices of the first segments touching, the remaining segments widely divergent, brown with some white tomentum and segments 1 and 2 furnished with long black bristles and hairs; segment 1 cylindrical, about as long as 3 and three times as long as 2 which is short and globular; 3 broadly conical; the style has its first segment somewhat rectangular and very much broader and longer than its second which is small, tholiform and deeply set and is with difficulty discerned; face white tomentose; cheeks white with grey tomentum and bearing long fine silvery hairs; proboscis brown, projecting as far forwards as two-thirds the length of the first segment of the antennae; palpi brown and about two-thirds the length of the proboscis.



Thorax chocolate brown, ornamented with a somewhat rectangular obliquely placed lateral area of yellowish tomentum just in front of the transverse suture and with two rather broad yellowish parallel stripes which extend for fully two-thirds the length of the dorsal surface; pleurae black, grey tomentose; scutellum shining black, the bristles are long, black and weakly developed; postscutellum black.

Abdomen has segments 1-5 dull black, densely silvery pollinose and the remaining segments shining black; segment 2 has a rather broad snow white hind margin; 2-4 each have a small patch of grey on the sides; venter shining black; genitalia mostly black-brown.

Legs black; anterior coxae mostly brown; apices of fore femora, base of fore tibiae, whole of middle and hind tibiae (except for a few patches of black) and bases of all tarsal segments brown.

Wings tinged grey, ornamented with two broad and one narrow, irregular, dark brown cross bands, the first of which crosses the apices of the basal cells, the second the median cell and the third just prior to the wing tip; halteres pale brown with yellow apices.

The female differs from the male by having the eyes separated by fully twice the width of the ocellar tubercle and by the uniformly shining black abdomen with segment 1 grey pollinose and segments 2-4 with the apical margins narrowly snow white.

Variations: The stripe on the thorax may extend the whole length of the dorsal surface, in which case they coalesce towards the apical third.

Habitat: New South Wales, Ryde (2 ♂, September, 1925); National Park (7 ♂, 1 ♀, I. M. Mackerras, September, 1925); Como (1 ♀, G. H. Hardy, October, 1921); Sydney (1 ♂, October, 1925); Queensland, Brisbane (2 ♂, G. H. Hardy, November, 1925; 8 ♂, F. Roberts, August, 1927; 22 ♂, 1 ♀, J. Mann, August, 1925).

This species is readily determined by the banded wings, silvery pollinose abdomen of the males, in conjunction with the large hypopygium.

A sand-frequenting Therevid, generally found in numbers where it occurs. The males dance and hover in the air with the long hind legs hanging downwards, reminding one of certain HYMENOPTERA. The silvery pollinose abdomen glistening in the sun makes the insect very conspicuous. The females are found running about the ground or resting on grass or amongst the foliage of low growing shrubs; I have never observed them hovering in the air as do the males.

#### Genus LONCHORHYNCHUS.

*Lonchorhynchus* White, Proc. Roy. Soc. Tasm., 1915.

Head subhemispherical, distinctly or slightly broader than long, slightly broader than the thorax; occiput deeply concave, fringed with black hairs and bristles; eyes bare, large, facets uniform, separated in both sexes, but slightly more so in the female than in the male, anterior margins parallel for a short distance and then diverging; ocellar tubercle of moderate size, oval, slightly raised and bearing tufts of black hairs and bristles; three ocelli; front broad, flattened and sculptured; antennal tubercle rather prominent; antennae, in relation to the anterior margin of the eye, set at about two-thirds its depth, shorter than the head (in *segnis* less than half the length) separated at the base with the apices of the first segments touching and the remaining segments widely divergent; the first and second

segments furnished with numerous black bristles and hairs and the third haired only; segment 1 is always cylindrical; 2 somewhat globular and 3 broadly conical when viewed in profile; style two-segmented the relative lengths of which segments vary specifically; the arista is always present and may be longer than the style; face small; proboscis stout and projecting forwards and upwards towards the antennae; palpi two segmented.

The thorax is convex above, longer than broad and furnished with 2-4 pre-alar, 1-2 inter-alar, 2 post-alar and sometimes 4-6 pre-scutellar bristles; scutellum semicircular and furnished with from 2-6 weak and strong marginal bristles; postscutellum convex and always well hidden beneath the scutellum.

The abdomen is elongate-conical or straight sided; one and one-third to two and one half times as long as the thorax.

The legs: both the tibiae and the tarsi bear numerous bristles but the femora are devoid of such.

The wings may be longer or slightly shorter than the abdomen, hyaline and somewhat clouded; M3 and M4 similarly with Cu1 and 1A coalesce well or just before the wing border; the costa and hind margin ciliated.

The sexes are mostly similar, differing only in the usual sexual characters and the specimens of any species show but little variation.

Genotype: *Lonchorhynchus nitidifrons* Macquart.

Range: Restricted to Australia.

Distribution: One species, *actuosus*, is known from Tasmania only; *segnis* extends from Tasmania into New South Wales and *nitidifrons* from Tasmania to Queensland.

*Lonchorhynchus* is readily recognised by the comparatively large size and shape, and by the position and length of the antennae.

In the material before me I have 3 specimens representing 3 new species which can be placed in this genus, but until more are forthcoming the describing of same is left in abeyance.

#### *Key to the Species of Lonchorhynchus.*

1. Femora wholly black. . . . . 2.  
Femora at most with a black stripe above; pleurae with a broad silver longitudinal stripe just above the coxae. . . . . *actuosus* White.
2. Front wholly black; thorax with faint indications of longitudinal stripes only; M3 and M4 coalesce well before the wing border. . . . .  
. . . . . *segnis* White.  
Front brown on the upper two-thirds; thorax with a broad velvet black dorsal stripe; M3 and M4 coalesce just before the margin. . . . .  
. . . . . *nitidifrons* Macquart.

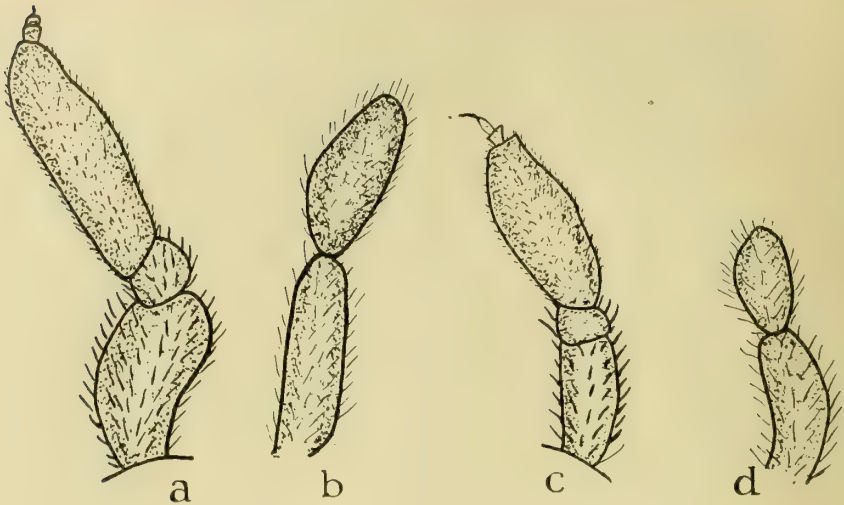


Fig. 6.

- a. antenna of *Lonchorhynchus actuosus* White.  
 b. Palp of same.  
 c. Antenna of *Lonchorhynchus nitidifrons* Macquart.  
 d. Palp of same.

#### LONCHORHYNCHUS ACTUOSUS.

*Lonchorhynchus actuosus* White, Proc. Roy. Soc. Tasm., 1915.

Length: 10-13 mm.

*Male*: Head slightly broader than long; occiput grey; eyes separated on the vertex by the width of the ocellar tubercle, anterior margins parallel for one-third the length of the front and from thence widely diverging but straight; ocellar tubercle brown-black; front dull black, greyish at the eye margins and just below the vertex, ornamented with irregular fine punctures or granulations and furnished with a few black hairs; antennal tubercle dull black but with some grey laterally; antennae black-brown, very slightly separated at the base, segment 1 short and thick being but two-thirds the length of 3 and at its greatest width slightly more than one half as long; 2 short, slightly more than one-fourth the length of 1; 3 rather longer than 1 and 2 united; the style is two-thirds the length of the second antennal segment and has its first segment somewhat rectangular and twice as long as its second; the arista is hardly as long as the apical segment of the style; face receding, grey tomentose; cheeks grey and furnished with long fine greyish hair; proboscis black-brown, brown haired and projecting as far forward as the apex of the first antennal segment; palpi two-thirds the length of the proboscis, the basal segment being slightly longer than the apical, brown and sparsely covered with long brown hair.

Thorax two-thirds as long as wide, slightly deeper than broad and slightly more than twice as long as the head; dull black ornamented with 5 irregular, interrupted, grey, longitudinal stripes; furnished with black



hairs and 4 pre-alar, 1-2 inter-alar, 2 post-alar and 4-6 pre-scutellar bristles, some of which may be but weakly developed; pleurae shining black with a broad silver longitudinal stripe just above the coxae; sparsely covered with greyish and brownish hairs; scutellum dull black dorsally and shining black laterally, with 2 strong and 2-4 weak black bristles; post-scutellum black-brown.

Abdomen two and one half times as long as the thorax; elongate-conical, flattened dorsally and ventrally; at its broadest point, about the same width as the thorax; shining black, segments 2-4 apically margined white which is interrupted medianly by a brown patch; furnished with black and greyish hairs; venter shining black; genitalia brown.

Legs dark brown; coxae covered with grey and black tomentum; femora with a black stripe above; tarsi black apically.

Wings slightly shorter than the abdomen, brownish tinged with indications of a dark brown band crossing the median cell; stigma dark brown, conspicuous; M3 and M4 coalesce well before the margin of the wing; 1A is somewhat concave and Cul meets same well before the border; the halteres are brown with yellow apices.

The female differs from the male in having a slightly broader frons and the brown of the legs brighter.

Variations: The brown of the legs may vary from bright to dark brown; the antennae may be black: the thorax may have grey on the anterior margin.

Habitat: Tasmania, Hobart (2 ♂, 1 ♀, December and January); Zeehan (1 ♂, February, 1924); Maria Island (1 ♂, December, 1924); all taken by G. H. Hardy.

Types: Co-type is in G. H. Hardy's collection, Brisbane.

This species is readily separated from the closely allied *nitidifrons* by having the white apical margin of the abdominal segments interrupted, and, by the presence of the silver pleural stripe.

#### LONCHORHYNCHUS SEGNIS.

*Lonchorhynchus segnis* White, Proc. Roy Soc. Tasm., 1915.

Length: 9-11 mm.

*Male*: Head distinctly broader than long; occiput black, dusted with greyish tomentum; eyes separated on the vertex by the width of the ocellar tubercle, anterior margins parallel for one-fourth the length of the front and from thence widely diverging and very slightly concave ocellar tubercle bearing tufts of black hairs and weak bristles; ocelli bright brown; front shining black, ornamented with irregular, roughly rugose sculpture and furnished sparsely with fine black and grey hair; antennal tubercle shining black with a longitudinal sulcus and furnished with greyish hairs; antennae black, slightly more than one half the length of the head, segment 1 half the length of 3; 2 half the length of 1; 3 longer than 1 and 2 united; the style is two-thirds the length of the second antennal segment and has its two segments of almost equal length but the first is considerably broader than the second; the arista is slightly longer than the style; face black, grey tomentose; cheeks grey and furnished densely with long fine white hair; proboscis black-brown, projecting as far forward as the apex of the second segment of the antennae; palpi black-brown, the basal segment one-fourth the length of the apical, the whole furnished with long greyish hair.

Thorax slightly longer than, and about as deep as broad, 3 times as long as the head; black with faint indications of 3 longitudinal stripes; furnished with short black hair and 2 pre-alar, 1 inter-alar and 2 post-alar bristles; pleurae black, grey tomentose and some bear tufts of black hair; scutellum dull black, somewhat brownish anteriorly and bearing 2 black bristles; postscutellum grey-black.

Abdomen as broad as and one and one-third times as long as the thorax, slightly more than twice as long as broad; parallel sided for three-fourths its length and from thence rounded to the apex; flattened above; dull black, with brownish reflections and covered with black and whitish hairs; segments 2-4 with the posterior lateral angles margined creamish; 6-7 brown laterally; venter of all segments with a great deal more brown, the posterior margins of 2 and 3 are white and the posterior lateral angles of 4 are white; genitalia brown.

Legs black; basal three-fourths of all tibiae and that of all the first tarsal segments bright brown.

Wings slightly longer than the abdomen and three times as long as broad; somewhat clouded; stigma distinct; M3 and M4 meet well before the border and Cu1 joins 1A, which is straight, well before the margin; cell M3 narrower but slightly longer than the median. The halteres are dark brown with yellowish apices.

The female differs from the male by having the eyes separated on the vertex by twice the width of the ocellar tubercle, a dull black front margined white laterally, the thorax with the anterior margin and the apical half laterally margined grey, segment 1 of the abdomen with the posterior lateral angles grey and by having the bright brown of the legs replaced by dark brown. The genital spines are reddish-brown.

Variations: Segments 2-4 of the abdomen may be wholly margined white or greyish and the general color of the abdomen may vary from black to black-brown.

Habitat: Tasmania, Hobart (G. H. Hardy, 3 ♂, 1 ♀, January, 1924 and 1916, and December, 1915; and C. E. Cole, 1 ♂ and 1 ♀, October, 1916); Mount Wellington (G. H. Hardy, 2 ♂, January, 1916); New South Wales, Blackheath (I. M. Mackerras, 1 ♂, February, 1926; G. H. Hardy, 1 ♀, November, 1919).

#### LONGCHORHYNCHUS NITIDIFRONS.

*Anabarrhynchus nitidifrons* Macquart, Dipt. Exot., Suppl. 4, p. 101, 1850.

*Lonchorhynchus nitidifrons* White, Proc. Roy. Soc. Tasm., 1915.

Length: 9-11 mm.

*Male*: Head broader than long, slightly broader than the thorax; occiput black; eyes separated on the vertex by the width of the ocellar tubercle, anterior margins parallel for half the length of the front and then widely diverging and slightly concave; ocellar tubercle brown and bearing tufts of stiff brown hairs; ocelli bright brown; front brown on the upper two-thirds, shining black on the lower with an indistinct, transverse, median, grey stripe ornamented with two transverse carinae and faint indications of five longitudinal striae or reticulation; antennal tubercle shining black with whitish reflections towards the sides; antennae black, segment 1 slightly more than two-thirds the length of 3; 2 short, being but one-third the length of 1; 3 about as long as 1 and 2 united; the style is about two-thirds the length of the second antennal segment and has its first segment somewhat rectangular, about as broad as long, and its second, conical and slightly longer but narrower than the first; the arista is hardly as long as the apical segment of the style; face grey tomentose; cheeks grey and densely furnished with long fine grey hair; proboscis black and projecting as far forward as the middle of the third antennal segment; palpi with the basal segment brown, considerably stouter and about two-thirds the length of the apical which is black, both segments are sparsely covered with long brown hair.

Thorax hardly twice as long as, and about as deep as broad; three times as long as the head; brown, ornamented with a broad, velvet, black, dorsal longitudinal stripe; furnished with long black hairs and 4 pre-alar,

1 inter-alar and 2 post-alar bristles; pleurae black, covered with grey tomentum and bearing tufts of brownish hairs; scutellum velvet black, covered with four black bristles and fringed with long black pubescence; postscutellum brown-black.

Abdomen two and one half times as long as and slightly narrower than the thorax, elongate-conical; shining black; segments 1-4 with a dorsal brown reflection; 2-4 with the apical margin broadly silver-grey; black, brown and white haired; venter similarly coloured and clothed; genitalia brown.

Legs: Femora black; tibiae and tarsi dark brown with black reflections; the basal two-thirds of the first tarsal segments somewhat lighter especially the posterior ones which are almost bright brown.

Wings hyaline with indications of a grey diagonal cross band; stigma not pronounced; M3 and M4 coalesce just before the margin; 1A is somewhat concave and Cu1 meets same well before the border; cell M3 narrower but longer than the median cell; costa and hind margin finely ciliated. The halteres are dark brown.

The female differs from the male as follows: Eyes separated on the vertex by as much again as the width of the ocellar tubercle, diverging for the whole length with the anterior margins straight; fringe of occipital bristles rather stronger; ocelli black; front broad and uniformly black; third antennal segment brown; first abdominal segment apically margined white; wings clouded grey; tibiae more black than dark brown; genital spines reddish.

Variations: The tibiae and tarsi vary in colour from dark brown to black.

Habitat: Tasmania, Wedge Bay (1 ♀, G. H. Hardy, January, 1914); Hobart (1 ♂, G. H. Hardy, January, 1924); New South Wales, Biniguy (1 ♀, J. Mann, December, 1923); Queensland, Brisbane (1 ♀, G. H. Hardy, October, 1927; 1 ♀, H. Hacker, October, 1912; 1 ♀, J. Mann, December, 1925).

#### Genus PHYCUS.

*Phycus* Walker, Ins. Saund., Dipt., pt. 1, p. 2, 1850.

This genus has not been recognised amongst the Australian material to date. White's interpretation of same has been referred to *Agapophytus* (vide synonymy notes under that genus).

Genotype: *Xylophagus canescens* Walker; by original designation.

#### PHYCUS DIOCTRIAEFORMIS.

*Phycus dioctriaeformis* Schiner, Reise Novara Dipt., p. 151, 1868; *Id.*, Kroker.

Ent. Mitt., 1, p. 122, 1912.

Described from Sydney and Botany Bay, New South Wales.

Has not been recognised.

#### PHYCUS PALLIDICORNIS.

*Phycus pallidicornis* Kroker, Ent. Mitt., 1, p. 124, 1912.

Male described from New South Wales.

Has not been recognised.

#### Addendum.

I wish to call attention to and correct the following errors in the first part of this series (Aust. Zool., Vol. v., pt. 2, May, 1928):

p. 166, line 31—for *kinbergia*, read *kinbergi*.

p. 193, lines 15, 16 and 17, "This species ——— from *ruficornis*" should be transposed to page 192 and follow on after line 32 at the end of the description of *Anabarrhynchus rufiventris*.

Commonwealth Prickly-Pear, Laboratory,  
Sherwood, Brisbane.



A MONOGRAPH OF THE AUSTRALIAN DRYOPIDAE.  
ORDER—COLEOPTERA.

By H. J. CARTER B.A., F.E.S., and E. H. ZECK.

(Plates i. to vii.)

[Fore-note by H. J. Carter.

While personally responsible for the collecting, or getting collected, the new species described I found the necessary examination of details, especially the dissection of the palpi, required the work of a younger eye and hand than mine if any real value could be attached to the new genera, and their correlation with existing genera occurring in other regions noted.

Mr. Zeck's special gifts as an entomological artist and as an experienced worker on minute Coleoptera, pointed to him as the ideal collaborator for this Monograph, and I wish here to record my great indebtedness to him for the added interest and value due to his work.]

After a full consideration of the "Recommendations"—in the nature of advice "of the British National Committee on Entomological Nomenclature," at Art 5 [Proc. Ent. Soc. Lond., 1928, p. 8R.] we are of opinion that the ordinary rule of priority should apply to the family name. The facts are as follows:—

*Dryops* Oliv., Encycl. Méthod., vi., 1791, p. 297, precedes its synonym.

*Parnus* F., Ent. Syst. I., 1792, p. 245.

By far the clearest classification and tabulation of the genera of the family is that of Ganglbauer, in his famous work, "Käfer von Mitteleuropa," 1904, p. 95, who then employed the family name DRYOPIDÆ. In the catalogue of Junk, now in general use, the family is edited by Zaitzev, 1910, under the name DRYOPIDÆ. The name has thus been in use for 25 years, and is recognized by a second authority 19 years ago. We are, moreover, following Ganglbauer's limitation of *Helmis* and other genera, and cannot consistently reject his authoritative opinion on the nomenclature.

The DRYOPIDÆ have been generally neglected by Australian collectors until recently, only nine species having been recorded previous to 1926. They are extremely numerous in individuals in Tasmania, Victoria and certain parts of New South Wales. Thus in a few days' visit in November, 1926, to the Allyn and Williams Rivers, with the help of Mr. John Hopson and Mr. C. Barrett, one of us collected no less than twenty different species, some in considerable numbers. In September, 1928, six species were captured in Galston Creek, near Hornsby, N.S.W., mostly on one log. Clear mountain streams, of which the above are typical, are specially suited to these curious and interesting beetles, whose life-history is very imperfectly known. Mr. A. J. Nicholson has taken the larvae of some undetermined species in two or three localities near Sydney, and one of us found larvae in the Williams River that cannot be correlated with any special imago. We are greatly indebted to Messrs. C. Barrett, J. E. Dixon, C. Oke and F. E. Wilson for their help in searching the Victorian streams and for sending specimens. The beetles are small, varying from one to five millimetres in length, and quite unable to swim, for which they have no adapted organs. They have a specific gravity greater than that of water, since when placed in water they invariably sink; but apparently obtain air from a surrounding aura due to a fine, felt-like coating, mostly on their ventral surface. This, however, as indeed the physiology in general of this family, needs investigation. One of us has kept living examples in a bowl of water for five months, without detecting any apparent attempt on the part of the beetles to reach the surface. Twenty-two examples, including *Notriolus*



*galstonius*, *Cozelmis novemnotata* and *C. trinotata* were thus kept alive in a bowl for five months. All we have seen are winged, and, frequently when examining a log taken from the river, some of them flew away as they dried in the sun. In two instances were found a *Sclerocyphon* sp. (DASCILIDAE) in the same habitat (Williams River) as noted by Lea and Carter in Tasmania.

The smaller species require care in handling and setting, being generally covered with slime or mud which obscures their characters. The dissection and mounting for examination minute organs like the palpi in the smaller species is no easy task, so that it is not surprising that few authors record the number of segments, even in the maxillary palpi, in describing new genera. Many authors describe the head as retractile; but this is only true of certain groups; and, so far as we have been able to examine, only partially so in any. Thus in *Kingolus* (*Elmis*) *metallicus* King, the head, in general sub-horizontally or obliquely placed, is capable of being moved into a vertical position, when the upper surface of the head (including eyes) forms a sort of operculum to the prosternal opening, the maxillae and palpi disappearing under the nozzle which then overlaps the prosternal lip.

We have found in the structure of the prosternum good characters for differentiating both genera and species. Plate v. clearly illustrates this and should be followed in conjunction with descriptions of new genera and species.

In 1864, the Rev. R. L. King described seven species under three genera, *Lutochrus*, *Elmis* and *Limnius*. Sharp, in 1882 (Biol. Centr. Amer.) transferred *Lutochrus australis* to *Hydrethus*, and also suggested that King's so-called *Elmis* and *Limnius* species would probably "have to be separated from the European genera so-named." In the same work he also admitted using for Central American species the generic name *Elmis* in the extended sense suggested by Leconte and Horn, and it would appear that Champion has followed a somewhat similar course in describing some Indian species (Ent. Mon. Mag., 1923, p. 170).

Grouvelle has also included under *Helmis* certain Madagascar species with polymorphic characters (Ann. Soc. Ent., Fr., 1906). Blackburn, Lea and Grouvelle have each described an Australian species under the same generic title, which three species seem to require generic differentiation.

After a study of some exotic, including New Zealand forms, kindly lent by the British Museum, as well as others courteously sent by the late Mr. G. C. Champion and Dr. R. J. Tillyard, also by Mr. A. E. Brookes, of Waikato, New Zealand, and of such literature as was available, we are unable to include the majority of the Australian species, so far known, under existing genera.

We propose to adopt the very clear tabulation of Ganglbauer (Käf. Mitteleur., 1904) as a basis for our classification, a tabulation that would definitely deny both *Helmis* (*Elmis*) and *Limnius* to our species, the former by its three-segment maxillary palpi and the structure of head and pronotum, the latter by its clothing and elytral sculpture (with four lateral granular striae). We would definitely refer *Helmis pallidipes* Cart. to the world-wide *Stenelmis* L. Dufour, which already contains species from New Guinea and Sumatra.

The New Zealand DRYOPIDAE are very distinct from the Australian, the two regions having no genus in common. Moreover, their four recorded genera all come under the sub-family *Dryopinae*, in which Australia has only a single genus with two species; while the sub-family, *Helminae*, numerous in Australia, is unrecorded from New Zealand. The sub-family *Psepheninae* is unrecorded in both of these regions.

## GENERA OF AUSTRALIAN HELMINAE.

1. Antennae with segments 5-11 sub-clavate. . . . . *Stetholus*.  
Antennae filiform. . . . . 2.
2. Fore tibiae with fringe of tomentum on inside. . . . . 3.  
Fore tibiae without fringe of tomentum on inside. . . . . 7.
3. Pronotum sub-bilobate (i.e., divided by distinct transverse depression). . . . . 4.  
Pronotum unilobate (without distinct transverse depression). . . . . 5.
4. Maxillary palpi 3-segmented, pronotum with short sub-lateral sulcus, claws simple. . . . . *Kingolus*.  
Maxillary palpi 4-segmented, pronotum without sub-lateral sulcus, claws enlarged (subdentate) at base. . . . . *Simsonia*.
5. Widely obovate, pronotum with sub-lateral and medial sulcus, elytra with three lateral ridges. . . . . *Austrolimnius*.  
Elongate-ovate, pronotum without sub-lateral or medial sulcus, elytra uniformly striate-punctate. . . . . 6.
6. Pronotum foliate in front, fore coxae closer than mid, metasternum not channelled, latero-apical margins of elytra serrulate. . . . . *Notriolus*.  
Pronotum deflexed at sides, fore coxae as wide apart as mid, metasternum channelled, elytral margins entire. . . . . *Cozelmis*.
7. Elongate, parallel, pronotum with irregular sub-lateral sulcus elytra striate-punctate, alternate intervals sub-costate. . . . . *Stenelmis*.  
Elliptic, pronotum with sub-lateral carina, elytra sub-granulose with sub-lateral carina. . . . . *Neosolus*.

The sub-family *Dryopinae* at present includes the single genus *Hydretus* Fairm. (Ann. Soc. Ent. Belg., 1889, p. 90) with two species, *H. (Lutochrus) australis* King, and *H. leai* Cart., which may be distinguished as follows:—

Form elliptic; elytra coarsely lineate-punctate. . . . . *australis*.  
Form more widely ovate; elytra more finely striate-punctate. . . . . *leai*.

*STETHOLUS* gen. nov.

Body elongate; head (thickly), pronotum and elytra (chiefly at sides), clothed with short, bristly hair; palpi 4-segmented, terminal segment of the maxillary palpi clavate, of the labial subulate; antennae with two basal segments very tumid and hairy; 1st very long, extending to the exterior margin of eye; 2nd much shorter, ovate, 3 and 4 bead like, each about half as wide as 2; 5-11 transverse, forming a flattened club, more or less perfoliate; 7-10 wider than 5-6 and sub-equal; 11th twice as long as 10, its base truncate, apex rounded.

Head large, free, vertical, incapable of withdrawal within prothorax; eyes large, round and prominent; prosternum very short, without mentonière; the fore coxae globular, placed near the front edge of prosternum, and only separated by the narrow, short, acutely pointed prosternal process; this with medial carina and raised border; mesosternum with deep, round pit mid and hind coxae rather widely separated; legs moderately developed, long, tarsal claws strongly developed. Posterior tarsi with last segment very long (nearly as long as the rest combined).

Pronotum bilobed, anterior lobe the more convex and divided from the posterior by a V-shaped depression; without sub-lateral excavations, anterior angles deflexed, margins feebly explanate behind only.

Scutellum large, triangular with rounded sides.

Elytra sub-parallel, striate-punctate.

The antennae are very similar to those of *Hydretus australis* King, on a larger scale; but in that species (of which the author did not describe

the antennae) the 1st segment is shorter, the 2nd proportionally longer, the 3rd clearly longer than 4, the 11th less than twice as long as 10, the clavate series (5-11) more compact and fusiform.

The prosternum is shorter than in any other Australian DRYOPIDAE known to us. The protibiae without tomentum.

Genotype: *S. elongatus* n.sp.

STETHOLUS ELONGATUS *sp. nov.*

(Plate ii., Fig. 16.)

Elongate oblong, nitid black (including upper surface of legs), under-side of femora, abdomen and sternal regions fawn colour, antennae, first two segments reddish, rest dark brown.

Head large, closely punctate and pilose (especially near eyes and anterior region), eyes large and rather prominent.

Prothorax narrowed and convex in front, sides of hind part arcuately widened to base without explanate margin or lateral border; base strongly bisinuate, posterior angles obtuse, disc rather coarsely punctate with two longitudinal foveae near scutellum, and a larger depression on each side.

Elytra considerably wider than prothorax, shoulders rather squarely rounded; sides sub-parallel (very feebly compressed behind shoulders and little widened behind middle), striate-punctate, the striae very lightly impressed and containing close small punctures; intervals flat and very minutely punctate, those nearer sides showing short fine pubescence. Each elytron with a large sub-gibbous area behind scutellum. Underside impunctate with a fine velvety derm, metasternum very minutely pustulose.

Dimensions: 5.3-6 x 2 mm.

Habitat: New South Wales, Allyn River, at Gresford, Williams River, at Dungog.

Twenty examples are before us taken by Messrs. Barrett and Carter at Dungog, and by H. J. Carter at Gresford, N.S.W.

The characters mentioned in the generic diagnosis sufficiently differentiate this interesting species.

Type: Series on card in Coll. Carter.

Holotype denoted by an arrow.

KINGOLUS *gen. nov.*

Form more or less ovate; glabrous above and below; head partially retractile, antennae filiform; 11 art; segments sub-equal; eyes large, moderately prominent; maxillary palpi 3-segmented.

Prothorax transverse, sub-bilobate, the narrower and more convex anterior part divided from the wider and flatter part by a transverse arcuate depression parallel to the sides and more or less carinate on its external edge; a short clearly excised sub-lateral sulcus extending from base, not (in general) reaching the transverse depression; disc not channelled in middle, base sub-truncate, apex slightly produced in the middle, margins narrowly explanate.

Scutellum large, triangular.

Elytra uniformly striate-punctate.

Prosternum moderately long; its hind process wide and truncate (*metallicus* King and *flavosignatus* n.sp.) or widely rounded (*aeratus* Cart.); the flattened medial area of underside bounded by sinuate ridges, converging between fore-coxae, expanding on metasternum and terminating at hind coxae; mid and hind coxae widely separated, fore tibiae with a narrow fringe of tomentum on inside, legs moderately long.

A genus that we cannot harmonize with recorded genera, though ap-

parently nearest to the E. African *Helminthopsis* and *Helminthocharis* of Grouvelle.

Genotype: *Elmis metallica* King.

*N.B.*—The fore-coxae are more widely separated than in either *Simsonia* or *Notriolus*. All the species so far recorded are brightly metallic, or metallic variegated with yellow markings.

#### KINGOLUS.

##### Table of Species.

- |  |                                |
|--|--------------------------------|
| 1. Unicolorous, metallic. . . . .  | 2.                             |
| Unicolorous, with pale maculae. . . . .  | 6.                             |
| 2. Form elongate, pronotum much narrowed in front. . . . .                     | <i>tyrrhenus</i> n.sp.         |
| Form widely obovate. . . . .   | 3.                             |
| 3. Upper surface violet bronze. . . . .  | 4.                             |
| Upper surface coppery. . . . .   | 5.                             |
| 4. Pronotum widest at middle, elytral punctures small (pl. 1, fig. 8). . . . . | <i>metallicus</i> King.        |
| Pronotum widest behind middle, elytral punctures larger. . . . .               | <i>aeratus</i> Cart.           |
| Pronotum widest at base, elytral punctures irregular. . . . .                  | <i>heroni</i> n.sp.            |
| 5. Upper surface nitid, sparsely punctate. . . . .                             | <i>tinctus</i> n.sp.           |
| Upper surface sub-opaque, densely and finely punctate (pl. 1, fig. 4). . . . . | <i>cupreus</i> Cart.           |
| 6. Pronotum with yellow markings. . . . .                                      | <i>flavoplagiatus</i> n.sp.    |
| Pronotum without yellow markings. . . . .                                      | 7.                             |
| 7. Yellow markings limited to humeral spots. . . . .                           | <i>yarrensis</i> n.sp.         |
| Yellow markings not so limited. . . . .  | 8.                             |
| 8. Four elytral maculae clearly defined, 2.4 mm. long. . . . .                 | <i>flavosignatus</i> n.sp.     |
| Basal maculae tending to coalesce, 1.8 mm. long. . . . .                       | <i>quatuor maculatus</i> King. |

#### KINGOLUS FLAVOPLAGIATUS sp. nov.

(Plate i., Fig. 3.)

Elongate and narrow, ground colour castaneous brown, sub-nitid, with yellow markings, as follows: Pronotum irregularly so coloured (in general the greater part), elytra with triangular basal area having the longest side extending from behind shoulders to basal third near suture; the apical third (leaving sides and suture brown); this varied by upper surface more largely flavous. Lateral area of underside, tibiae, tarsi and antennae also testaceous.

Head and pronotum finely, regularly, not closely punctate, antennae similar, but narrower than the preceding (*H. flavosignatus*).

Prothorax sub-bilobate—a wide medial area convex throughout, transverse depression towards sides deeper than in *flavosignatus*, the sides more strongly sinuate at their junction with depression; anterior lobe more convex (hooded) and arcuate at apex; anterior angles invisible from above, widest near the feebly bi-sinuate base, sides behind sinuation very slightly rounded, hind angles sub-rectangular, a rather wide concavity within narrow border, a wide and deep sub-lateral longitudinal sulcus, extending over about two-thirds of posterior lobe and terminating anteriorly in sharp point.

Scutellum punctate, shaped as in the preceding.

Elytra slightly wider than prothorax at base, elongate, obovate, a distinct lateral flange becoming obsolete at shoulders; striate-punctate, the striae well impressed, intervals sub-convex in places, generally rather flat, seriate punctures large and round, more closely set than in the preceding



species; intervals minutely punctate, bearing setae more thickly than in *flavosignatus*. Underside coarsely punctate on the darker medial area.

Dimensions: 1.8 x 0.7 mm.

Habitat: New South Wales, Williams River, at Dungog (C. Barrett and H. J. Carter).

Six examples taken are clearly separated from any described species by the combination of small size, elongate, narrow form, pale colour, with irregular markings.

Holotype: In Coll. Carter.

#### KINGOLUS (LIMNIUS) QUATUOR MACULATUS King.

(Plate i., Fig. 5.)

This species is certainly not a *Limnius* and is clearly a member of the same genus as *Elmis metallica* King. Fifteen examples were taken at Eccleston (Allyn River and Massie's Creek) in October, 1926, which have been compared with King's type in the Australian Museum. Also taken at Galston. As stated by the author, the basal maculae tend to coalesce; the pre-apical maculae are narrow, elongate and are set obliquely, while in most examples there is an indistinct pale vittate interval, parallel to the suture. The pronotum is bilobate and with the elytral intervals, minutely punctate. The latter quite flat.

Dimensions: 1.6 x 0.7 mm.

Except *H. tyrrhenus* and *H. tinctus* n.sp., it is the smallest of the group in which it is placed.

#### KINGOLUS FLAVOSIGNATUS sp. nov.

(Plate i., Fig. 1.)

Rather widely ovate, nitid castaneous bronze above and below, elytra with two humeral and two elongate sub-apical spots yellow, antennae, tibiae, tarsi and hind border of abdominal segments testaceous.

Head and pronotum with moderately large, sparsely and irregularly placed punctures; antennae linear, apical segment tapering to a point.

Prothorax very partially bilobate, a wide nearly straight transverse depression on each side, leaving rather widely uninterrupted, convex, medial surface; apex arcuate, anterior angles a little produced, base feebly bisinuate; widest near middle, sides moderately rounded, sinuate in front of middle; posterior angles sub-rectangular, with narrow lateral border, slightly varied, having wide punctate concavity (sub-explanate) within, bounded on the inside by a deep longitudinal sulcus, extending from base, but not reaching the transverse depression.

Scutellum sub-ovate, with truncate base, impunctate.

Elytra: Shoulders obliquely rounded, sides slightly widened behind middle, horizontal border distinct; striae-punctate, the striae shallow, seriate punctures round and large, intervals flat, each with a single line of large punctures (of about half the diameter of the seriate) bearing short golden setae. Prosternum densely and coarsely, meso- and metasterna more sparsely but equally coarsely punctate, abdomen with nitid medial area, the segments successively more finely punctate from base to apex; a wide lateral area opaque and impunctate; front tibiae with a sparse fringe of hair on inside near apex.

Dimensions: 2.3 x 1 mm.

Habitat: New South Wales, Allyn and Williams Rivers (H. J. Carter).

Seven examples taken. Also taken at Dorriggo by Mr. W. Heron. It is clearly distinct from all described species by its combination of castaneous

bronze ground colour, four spotted elytra, coarsely punctate surface and rather wide form.

Holotype: In Coll. Carter.

*KINGOLUS HERONI* sp. nov.

(Plate vi., Fig. 75.)

Rather widely obovate; purple bronze above; underside tawny brown; red on pro- and mesosternum, antennae and legs yellow, the former with apical segment, the latter with knees dark.

Head: Antennae rather short and linear; eyes large but not prominent.

Prothorax: Apex bisinuate; medial lobe widely rounded and produced; anterior angles acute and produced; base nearly straight; posterior angles sub-rectangular; lateral border very narrow; strongly bilobed, divided by a deep and slightly sinuate depression; this forming a distinct sinuation at sides; widest at base, thence slightly and arcuately narrowed to the depression; thence nearly straight to apex; disc strongly but not closely punctate, with well marked sub-lateral sulci, parallel to sides, extending from base about one-third way to the transverse depression.

Scutellum: Equilatero-triangular, with rounded sides.

Elytra wider than prothorax at base, widest behind middle, margins entire, rather bluntly and jointly rounded at apex; striae-punctate; the seriate punctures irregular in size; the striae vaguely impressed, intervals flat and themselves irregularly but strongly punctate; the interstitial punctures not as large as the seriate.

Prosternum closely and strongly punctate, the hind process wide, truncate at apex and sub-sinuate at sides; metasternum more finely punctate; abdomen nearly impunctate; claws simple.

Dimensions: 2.1 x 1 mm.

Habitat: New South Wales, East Dorrigo (W. Heron).

Examples sent by Mr. Heron, after whom we name it, as he is one of the few collectors who has succeeded in finding the small species of this family. It is nearest *K. aeratus* Cart., but is distinguished by its pale legs and the very different elytral sculpture (the seriate punctures regular and round in *aeratus*), the intervals more strongly and irregularly punctate.

Holotype: In Coll. Carter.

*KINGOLUS TYRRHENUS* sp. nov.

(Plate i., Fig. 6.)

Rather elongate, narrowly obovate, bright violet bronze, antennae femora, tibiae, tarsi and medial area of underside testaceous, the last shading off to brown towards the sides.

Head and pronotum sparsely and finely punctate, antennae linear, apical segment tapering to a fine point.

Prothorax sub-bilobed, anterior part not entirely divided from the posterior by two wide, shallow, transverse depressions not quite meeting at the middle; apex sub-truncate, base bi-sinuate, all angles sub-rectangular. widest slightly before middle, sides lightly and evenly rounded, much more narrowed anteriorly than posteriorly; lateral border very narrow, with a moderately wide explanate or sub-convex area within this, followed after a short interval by a deep, wide longitudinal sulcus, extending from the base to the transverse division.

Scutellum large, triangular, with rounded sides.

Elytra wider than prothorax at base, widest behind middle, striae-punctate, the striae shallow, seriate punctures round, rather small and well separated, intervals flat and very sparsely punctate, a single irregular row of punctures on each—a narrow lateral border visible from above.

Underside non-pilose, prosternum flat, truncate at apex, hind process wide and widely rounded behind, metasternum finely channelled, sparsely and finely punctate, abdomen apparently impunctate.

Dimensions: 1.7 x 0.7 mm.

Habitat: New South Wales, Allyn and Williams Rivers (H. J. Carter).

Eleven specimens taken and examined. The species could only be confused with *K. metallicus* King, which differs as follows: Colour deeper purple bronze, often with metallic gleams in punctures and sides; legs dark, as also the apical segment of antennae pronotum more strongly bilobed, the depression causing a break in the elytral series; intervals wrinkled and punctate.

Holotype: In Coll. Carter.

*KINGOLUS METALLICUS* King.

We took 32 examples in the Allyn and Williams Rivers. Fresh specimens are a brighter purple bronze than in the type, the punctures showing a metallic sheen; but when viewed in a good light the colour can be seen on the two specimens (of which one is the presumable type) in the Australian Museum, while the sculpture is identical with my specimens. This shows a wide range, King's examples coming from the Murray River.

*KINGOLUS TINCTUS* sp. nov.

(Plate i., Fig. 7.)

Widely obovate, clear nitid bronze, antennae testaceous, tarsi and tibiae darker, flavous; underside dark brown.

Differs from *K. tyrrenus* by its shorter, wider form, deeper purple colour, darker legs and underside; the prothorax is wider, less narrowed in front, the sides a little sinuate near the transverse depression, the pronotum more finely and sparsely punctate, the longitudinal sub-lateral sulci shorter, extending over the basal third only of the posterior lobe; the elytral series coarser, the striae deeper, the intervals flat and sparsely punctate.

Dimensions: 1.6 x 0.8 mm.

Habitat: Allyn River (Mr. John Hopson).

Five examples taken by Mr. Hopson are near *K. tyrrenus* and *K. metallicus* King, in colour. From the former it is distinguished above; from the latter by its short, wide form, finer pronotal sculpture, with the short sub-lateral excavation and different elytral sculpture.

Holotype: In Coll. Carter.

*KINGOLUS YARRENSIS* sp. nov.

(Plate vi., Fig. 79.)

Rather widely ovate, purple bronze, elytra with small pale shoulder spot, tibiae and tarsi (partly) and basal half of antennae yellow.

Head minutely punctate, antennae linear, moderately stout (basal segments about as thick as basal segments of tarsi).

Prothorax bilobate, anterior third separated by a wide V-shaped transverse depression, apex and base a little sinuate, the former lightly emarginate, widest near base, sides here just perceptibly rounded with a tendency to become sinuous near the transverse depression, all angles sub-acute, a narrow sub-explanate margin limited externally by a thin revolute border; on each side a wide and deep sub-lateral sulcus extending over three-quarters of the basal lobe parallel to the sides, these connected behind by a fine transverse depression near base; disc with fine, distant punctures superimposed on a minutely criss-crossed surface.

Elytra widely obovate, as wide as prothorax at junction, enlarging immediately behind this, sides nowhere parallel, margins invisible from above; striate-punctate, the striae shallow, seriate punctures small and distant, intervals flat, sparsely but clearly punctate; underside entirely metallic and dark, without perceptible hair, pro- and meso-sternum rather coarsely and sparsely, abdomen more finely and closely punctate; femora and base of tibiae and upper surface of tarsi dark, rest of legs flavous.

Dimensions: 2 x 1 mm. (approximately).

Habitat: Warburton, Victoria (F. E. Wilson).

Three examples sent by their captor can readily be separated from *metallicus*, *aeratus*, *tyrrhenus*, *tinctus* and *leai* by the presence of the shoulder spot and many details of sculpture.

Type: In Coll. Carter.

#### *SIMSONIA* gen. nov.

Elongate, head partly retractile, antennae 11-art., filiform, extending to about the middle of prothorax, two basal segments enlarged, apical segment about as long as 9-10 combined; maxillary palpi 4-art.; last segment ovate.

Prothorax elongate, sub-bilobate, divided by a transverse depression (generally more or less V-shaped), the anterior part very convex and forming a hood produced over head; sides more or less sinuate, margins explanate; base bisinuate.

Scutellum sub-circular.

Elytra striate-punctate.

Prosternum rather short, its hind process narrowed and rounded behind. Front coxae closer than the mid coxae.

Metasternum channelled in middle; legs moderately long; tibiae fringed with tomentum, claws, especially the posterior with an enlargement (sub-lobate) at base.

Genotype: *Elmis tasmanica* Blackb.

#### *SIMSONIA*.

- |   |  |
|---|--|
| 1. Upper surface black. . . . .                             | 2.   |
| Upper surface metallic. . . . .                             | 6.   |
| Upper surface with four pale maculae. . . . .               | <i>tasmanica</i> Blkb. (pl. iii., fig. 18).  |
| 2. Elytral intervals pilose. . . . .                        | <i>vestita</i> n.sp.                         |
| Elytral intervals glabrous. . . . .                         | 3.   |
| 3. Pronotum with sub-lateral carina. . . . .                | <i>hopsoni</i> n.sp.                         |
| Pronotum without sub-lateral carina. . . . .                | 4.   |
| 4. Elytral intervals more or less uniform. . . . .          | 5.   |
| Third interval callose near base. . . . .                   | <i>irregularis</i> n.sp.                     |
| 5. 5 mm. long; elytral sculpture coarse and deep. . . . .   | <i>nicholsoni</i> Cart. (pl. iii., fig. 23). |
| 2 mm. long; elytral, sculpture fine and shallow. . . . .    | <i>angusta</i> Cart. (pl. ii., fig. 13).     |
| 6. Colour purple bronze, elytral sculpture coarser. . . . . | 7.   |
| Colour brownish bronze, elytral sculpture finer. . . . .    | <i>wilsoni</i> Cart. (pl. iii., fig. 20).    |
| 7. Pronotum with sub-lateral carina. . . . .                | <i>leai</i> n.sp.                            |
| Pronotum without sub-lateral carina. . . . .                | <i>purpurea</i> Cart. (pl. iii., fig. 22).   |

#### *SIMSONIA HOPSONI* sp. nov.

(Plate iii., Fig. 24.)

Elongate ovate, convex, nitid black above, dull brown beneath, antennae and tarsi red.

Head and pronotum very finely punctate, eyes little prominent; an-



tennae filiform, short and slender, extending little beyond the apex of prothorax.

Prothorax rather strongly convex, scarcely or very feebly bilobed, the anterior area partly separated by short, shallow depression extending transversely from the side half way to suture, apex much narrower than base, the latter rather strongly bisinuate, sides rounded, weakly sinuate anteriorly, widest behind middle, hind angles a little more than 90 degrees; a very thin lateral border slightly explanate within; disc with a transverse sulcus near base, and two short longitudinal ridges emphasized by depressed area on their inside, towards the sides.

Elytra obliquely widened at shoulders, thence sides nearly straight to the widest part behind middle, apical declivity somewhat steep; striate-punctate, striae deep and wide, seriate punctures very large and round, intervals convex, especially at base and moderately wide—one forming a distinct humeral callus and themselves covered with punctures; pro-, meso- and metasternum rather coarsely, abdomen more finely punctate; mesosternum with a deep pit; fore tibiae with a fringe of hair on inside.

Dimensions: 4.3 x 2 mm.

Habitat: New South Wales, Eccleston (Allyn River and Massie's Creek, H. J. Carter); Williams River (four miles above Salisbury, F. E. Wilson and H. J. Carter); Cox River, near Hartley, Blue Mountains (H. J. Carter).

Eight examples taken during a recent visit to the late Mr. John Hopson, the naturalist of that district, after whom I name it. Others were sent me later by Mr. F. E. Wilson, and a single specimen taken in the Cox River, Blue Mountains, in January, 1927.

By its size and nitid black surface it may be at first confused with *Notriolus barretti* Cart. from the same region, but the bilobed pronotum at once distinguishes it, besides the unusually coarse elytral sculpture, the enlarged tarsi, and the different prosternal structure.

Holotype: In Coll. Carter.

*SIMSONIA LEAI* sp. nov.

(Plate i., Fig. 2.)

Elongate, very slightly obovate, dark purple bronze, moderately nitid, legs tarsi and underside dark, the last black or nearly so, basal half of antennae yellow.

Head rather wide, the eyes prominent, antennae linear.

Prothorax bilobate, the anterior lobe more convex, divided from the posterior by an uninterrupted, nearly straight transverse depression, forming a sinuation at the otherwise nearly straight (feebly arcuate) lateral border, this narrowly horizontal within, posterior angle sub-rectangular, base nearly straight. Disc strongly sparsely and unevenly punctate, an indistinct prebasal furrow and a short sub-lateral carina as in *hopsoni*.

Scutellum punctate, triangular with rounded sides.

Elytra considerably wider than prothorax at base, shoulders widely rounded, horizontal border evident from above; striate-punctate, the two sub-lateral striae only well marked and wide, the rest scarcely impressed, seriate punctures unusually large, round and close, intervals convex at base, elsewhere flat, each with a single, irregular line of small punctures and slightly transversely rugose. The whole sternal regions and the basal segment of abdomen coarsely punctate, the rest of abdomen scarcely punctate.

Dimensions: 2.4 x 1.1 mm.

Habitat: New South Wales, Williams River (H. J. Carter, 4 miles above Salisbury). Five examples taken near the camp of the R.A.O.U. in October, 1926. This species is of the size and general outline of *Simsonia purpurea*

and *S. wilsoni*, but may be distinguished by its pronotal sculpture and large seriate punctures of elytra, besides its prosternal structure.

Holotype: In Coll. Carter.

Dedicated to an old friend and fellow coleopterist, A. M. Lea.

*SIMSONIA IRREGULARIS* sp. nov.

(Plate ii., Fig. 14.)

Elongate, ovate, convex, subnitid black above, brown or reddish beneath; antennae tarsi, and (in part) tibiae red.

Head densely punctate, eyes flat, labrum ciliate, apical segment of maxillary palpi wide and truncate, antennae rather short, extending to middle of pronotum, two basal segments much widened, 3-10 very lightly successively widened, 11th about twice as long as ten.

Prothorax bilobate, divided by a shallow V-shaped transverse depression, anterior convex part produced in middle, posterior flatter area with lateral explanation, without medial channel, base bisinuate, sides widest at basal third, thence lightly converging behind, more strongly but nearly straight towards the front; the extreme border lightly raised, entire; hind angles sub-rectangular, front angles rounded off and depressed; disc closely covered with round deep punctures, coarser at sides and base, finer towards apex.

Scutellum oval, narrowed behind.

Elytra at shoulders considerably wider than the base of prothorax, scarcely widened behind middle; striate-punctate, the seriate punctures large and round (very like those in *hopsoni*, except the punctures in 1st stria much larger) the intervals rough, punctate and subgranulose, the 3rd interval near base, also the 6th and 7th near shoulders, with a widened convex elevation, the wide sutural interval also convex, surface near sides with a short bristly clothing; prosternum and flattened part of metasternum strongly and closely punctate, the hind process of the former elongate and narrowly rounded behind, the latter channelled in the middle, abdomen with very fine, shallow punctures, all tibiae with short scaly bristles, the fore tibiae with a fringe of tomentum, claws sub-dentate at base.

Dimensions: 4.5 x 1.8 mm.

Habitat: Upper Barrington River, 4,700 ft. alt. (H. J. Carter).

Two examples were taken near the "Bull-head Crossing" in January, 1927. It is shorter and proportionally wider than *tasmanica* Blkb., its seriate punctures are intermediate in size between those of *tasmanica* and *nicholsoni*, but distinguished from any of the Australian Helminae by the irregular elevations at the base of the elytra.

Holotype and Paratype: In Coll. Carter.

*SIMSONIA VESTITA* sp. nov.

(Plate iii., Fig. 19.)

Elongate ovate, black, moderately nitid above, brownish beneath; antennae and tarsi reddish.

Head: Antennae short, lineate, segments 1 and 2 wide, 3-10 sub-equal, 11th rather longer, narrower than preceding and pointed.

Prothorax widest behind middle, thence obliquely narrowed to front, more abruptly to base; anterior angles acute, posterior obtuse; base lightly bisinuate, sides narrowly explanate throughout; disc sub-bilobate, anterior hood-like portion divided from basal area by a lightly impressed V-shaped depression; whole surface strongly and densely punctate, the punctures on the anterior lobe larger and less crowded than those on the basal area. (N.B.: In *S. nicholsoni* the reverse is the case).

Scutellum large, round and punctured like the base of pronotum.

Elytra wider than prothorax at base, shoulders rounded, sides subparallel for the greater part, apices conjointly rounded; striae punctate, with rather large round punctures, well separated, in well marked striae; the first two striae more deeply impressed than the others; intervals a little convex, sub-equal in width, strongly punctate and where not abraded clothed with reddish recumbent hairs. Sternal regions coarsely cellulose-punctate, prosternal process bordered at sides, rather sharply rounded at apex; a narrow medial part of abdomen less coarsely but similarly punctate; the punctured area quite glabrous; sides of abdomen with a fine felt-like opacity, apical segment with fringe of hair; tibiae fringed, tarsal hooks slightly lobed at base.

Dimensions: 4.9 x 1.8 mm.

Habitat: Mount Victoria, Western Victoria (Victorian Field Naturalists' Club Expedition) per Mr. F. E. Wilson.

Six examples sent can only be confused with *S. nicholsoni*, the only other species of large size, and black colour. It is, however, easily distinguished by its elytral clothing, the finer and more distant seriate-punctures, the less widely explanate pronotum, with its shallower transverse depression and different sculpture.

Holotype returned to Mr. Wilson for inclusion in the National Museum, Melbourne.

#### AUSTROLIMNIUS *gen. nov.*

Form short and widely obovate; head partially retractile; antennae narrowly linear, 11-segmented, 1 and 2 stouter than the rest and subequal, 3-10 equal, 11 much longer than 10, lanceolate; maxillary palpi 4-segmented; pronotum not transversely divided, a sub-lateral sulcus bordered by carina throughout, separating a wide sub-explanate margin from disc; and a well-defined longitudinal medial sulcus.

Scutellum forming a sub-equilateral triangle.

Elytra with three lateral ridges, the two interior (at least) bordered by a row of punctures, the outermost forming the extreme edge, the innermost in a line continuous with pronotal carina; disc with six series of punctures; anterior coxae moderately widely, the medial and post coxae widely separated; prosternal process short and wide, narrowing and rounded at apex; protibiae with fine fringe of hair on inside.

Genotype: *A. (Elmis) politus* King.

Near *Limnius*, but is without the felt-like tomentum on head and pronotum, the latter clearly canaliculate in the middle and having only three lateral ridges on elytra.

#### AUSTROLIMNIUS.

##### Table of Species.

- |  |                           |
|--|---------------------------|
| Elytra with 4 red spots. . . . .   | <i>luridus</i> n.sp.      |
| 1. Upper surface opaque black. . . . .   | <i>montanus</i> King.     |
| Upper surface nitid black. . . . .   | 2.                        |
| 2. Margins of pronotum and elytra (seen from above) entire; post and mid-tibiae of male sub-dentate. . . . . | <i>victoriensis</i> n.sp. |
| Margins of pronotum and elytra (seen from above) serrulate, tibiae simple in both sexes. . . . .             | <i>politus</i> King.      |

#### AUSTROLIMNIUS VICTORIENSIS *sp. nov.*

(Plate ii., Fig. 10.)

Rather widely obovate, nitid black above, brownish beneath; palpi, antennae, tibiae and tarsi, also underside of femora pale red; anterior margin of pronotum reddish.

Prothorax wide, convex and produced in front; sides nearly straight, posterior angles rectangular, margins with lateral explanation delimited throughout by sub-lateral sulcus bordered externally by a carina, the extreme border entire, disc with a deep median sulcus, its surface microscopically sub-granulose.

Elytra as wide as prothorax at base, widest behind middle, with three lateral carinate ridges throughout, the innermost forming the continuation of pronotal carina, the two outer closer together, the outermost forming the lateral border, this entire; disc of each elytron with three series of moderately large punctures (larger than in *A. politus* King), besides a row of punctures on inside of carina; general surface like that of pronotum; underside nearly smooth, prosternal process short, wide, rounded at apex; legs rather long, the mid-tibiae of male strongly dentate on inside, a little behind the middle, the hind tibiae of male compressed and widened; in the female the tibiae are normal.

Dimensions: 1.6 x 0.7 mm.

Habitat: Victoria, Healesville and Warburton (Mr. F. E. Wilson); Eltham (Mr. C. Barrett); Fern Tree Gully (Mr. J. E. Dixon).

Fifteen examples examined. It is very near *A. politus* King with which it was at first confused; but clearly separated from that species by the following:—

- (a) Less polished surface.
- (b) Prothorax longer, more parallel, with reddish front margin medial channel wider.
- (c) Less widely ovate elytra.
- (d) Margins of pronotum and elytra entire (of *politus* minutely serrate, the marginal carina being finely pustulose).
- (e) Legs longer, with sexual characters of mid and hind tibiae.

Holotype and Allotype in Coll. Carter.

*Note*.—*A. politus* King (pl. ii. fig. 15); *A. montanus* King (pl. ii., fig. 11).

These scantily described species are readily distinguishable from each other by the opaque surface and the much stronger sculpture of *montanus*. Both have the pronotum with sub-lateral sulcus; the elytra with three carinate ridges as in *victorienensis*, which in *montanus* are more or less pustulose; in *politus* only the outermost very finely so; both have series of punctures on inside of 1st and 2nd carina.

#### AUSTROLIMNIUS LURIDUS *sp. nov.*

(Plate vi., Fig. 78.)

Widely ovate; head and pronotum black, anterior margins of the latter reddish; elytra black with four red plagae; antennae, tibiae and tarsi pale red; underside dark, tinged with red; eyes large, not prominent; antennae as in *A. politus*.

Prothorax convex, produced in front, widest at base, sides arcuately converging to apex, posterior angles rectangular, margins entire, lateral explanation delimited by continuous sub-lateral sulcus, disc microscopically subgranulose, with a faintly defined medial sulcus.

Elytra margins finely serrulate, seriate punctures rather more distinct than in *A. politus*, the intervals nitid and laevigate, the middle lateral carina nearer the margin than in *politus*.

Underside apparently impunctate, the prosternal process narrowed and sinuate towards apex, its posterior sides straighter than in *politus* (c.p., pl. v., figs. 34 and 35).



## Dimensions:

Habitat: New South Wales, Galston, near Hornsby (Mr. J. Armstrong and the authors).

In February, 1929, we took 15 examples of the above, together with five examples of *A. politus* King. It is clearly distinguished from this species by its patterned elytra, its faintly defined medial line of prosternum and its different prosternal process. The elytral markings consist of two large shoulder and two oval subapical spots, the latter lying immediately within the inner sublateral sulcus.

Holotype in Coll. Carter.

NOTRIOLUS *gen. nov.*

Ovate or elongate ovate. Differs from *Simsonia* in the following characters: Antennae with basal segment less enlarged, the pronotum shorter and more transverse, uni-lobate (i.e., not divided by a transverse depression), sides in general rounded, margins less explanate, base nearly straight. The prosternal process is shorter and wider, truncate or widely rounded behind, claws without evident basal enlargement.

Genotype: *N. (Helmis) quadriplagiatus* Cart.

## NOTRIOLUS.

## Table of Species.

- |   |  |
|---|--|
| 1. Upper surface black, concolorous. . . . .                                  | 2.   |
| Upper surface with pale markings. . . . .                                     | 5.   |
| 2. Very nitid above, pronotum wide and explanate. . . . .                     | 3.   |
| Subnitid, pronotum narrow, scarcely explanate. . . . .                        |  |
| . . . . . <i>allynensis</i> Cart. (pl. iv., fig. 27.)                         |  |
| 3. Pronotum with transverse ridge, its basal region flattened. . . . .        |  |
| . . . . . <i>subplanatus</i> n.sp. (pl. vii., fig. 23.)                       |  |
| Pronotum not so. . . . .  | 4.   |
| 4. Pronotum widest at middle, sides evenly rounded. . . . .                   | 5.   |
| Pronotum widest behind middle, sides less rounded. . . . .                    |  |
| . . . . . <i>barretti</i> Cart. (pl. iv., fig. 31.)                           |  |
| Pronotum densely and strongly punctate. . . . .                               |  |
| 5. Elytral series almost hidden in deep striae. . . . .                       |  |
| . . . . . <i>simsoni</i> Grouv. (pl. iv., fig. 32.)                           |  |
| 6. Pale markings limited to humeral maculae. . . . .                          |  |
| . . . . . <i>humeralis</i> n.sp. (pl. iv., fig. 25.)                          |  |
| Pale markings consisting of four elytral maculae. . . . .                     | 7.   |
| 7. Nitid above, pronotum strongly transverse. . . . .                         | 8.   |
| Sub-opaque above, pronotum much narrower. . . . .                             |  |
| . . . . . <i>maculatus</i> Cart. (pl. iv., fig. 26.)                          |  |
| 8. Elytra very convex, sub-gibbous behind scutellum. . . . .                  | 9.   |
| Elytra normally convex. . . . .   | <i>victoriae</i> n.sp. (pl. ii., fig. 12.)       |
| 9. Pronotum widest at middle. . . . .   | <i>quadriplagiatus</i> Cart. (pl. iv., fig. 29.) |
| Pronotum widest behind middle. . . . .  | 10.  |
| 10. Underside black, prosternal process narrowed and rounded at apex. . . . . |  |
| . . . . . <i>galstonius</i> n.sp. (pl. vii., fig. 82.)                        |  |
| Underside reddish brown, prosternal process rather widely truncate. . . . .   |  |
| . . . . . <i>dorrigensis</i> n.sp. (pl. vii., fig. 81.)                       |  |

## NOTRIOLUS DORRIGOENSIS sp. nov.

(Plate vii., Fig. 81.)

Rather widely oval, convex; black above; elytra with four orange-red plagia, two at shoulders, two on apical declivity; antennae and tarsi red; under side dark reddish brown; coxae, greater part of metasternum and the post intercoxal plate paler red. Head and antennae as in *N. quadriplagiatus* Cart.

Pronotum with the apex more strongly sinuate, the anterior angles more pronounced, the external border more elevated; the surface uniformly punctate, more densely and finely so than in *quadriplagiatus*, widest behind middle, sides subsinuate behind. (In *quadriplagiatus* widest at middle, without sinuation behind). A transverse sulcus near base.

Elytra, obovate, strongly convex; lateral margin narrowly horizontal and minutely crenulate; striae punctate, the striae punctures smaller than in *quadriplagiatus* and the intervals, almost impunctate, without the pronounced wrinkles of that species.

The under side is so different that it is most clearly described by the following comparison:—

*dorrigoensis*.*quadriplagiatus*.*Prosternum*.

Posterior process rather widely truncate, with sharp angles; almost impunctate, a few shallow depressions.

Posterior process rounded; coarsely punctate.

*Metasternum*

Non-sulcate, nitid and almost impunctate; hind margin sharply and widely angulate in middle.

Longitudinal sulcus in middle; coarsely punctate; hind margins undulate, scarcely angulate in middle.

*Abdomen*.

Sub-nitid and finely punctate in middle, velvety pubescent at sides and apex; apical segment non-sulcate.

Strongly punctate in middle, velvety pubescent at sides and apex, apical segment sulcate.

Dimensions: 3.4 x 1.7 mm.

Habitat: New South Wales, Dorrig (Mr. W. Heron).

Six examples were recently sent us (December, 1928) by Mr. Heron amongst other DRYOPIDAE. The species is very like *N. quadriplagiatus* as to the upper surface, especially in the strong convexity of the elytra behind the base with the corresponding steep basal declivity; but it is more robust, with longer and much thicker legs, and with finer sculpture; also the elytral plagia are smaller than in the Victorian species. As shown above, the most marked distinctions lie in the very different under surface.

Type in Coll. Carter.

Curiously, one example sent by Mr. Heron is inseparable from *N. quadriplagiatus* Cart., having the coarser upper surface, pronotum widest at middle, black and strongly punctate under surface, but having the hind margin of the metasternum as in *dorrigoensis*. We can only consider this as a slight variety of *quadriplagiatus*.

We have a single female example from Galston, New South Wales, which again is very slightly differentiated from Victorian examples of *quadriplagiatus* by larger size, paler under surface and legs; prosternal

process clearly rounded and narrowed at apex; and the hind margin of metasternum as in the *Dorrigo* example.

In the original description of *quadriplagiatus*, Proc. Linn. Soc. N.S.W., 1926, 62, the word "concavity" (of the elytra) is erroneously printed for "convexity."

*NOTRIOLUS GALSTONIUS* sp. nov.

(Plate vii., Fig. 82.)

Rather widely obovate, nitid black; elytra with four spots rufo-flavous, two at shoulders, two sub-apical; antennae and tarsi yellow, tibiae red; underside black.

Head and pronotum densely punctate, the latter very convex, widest behind middle, the sides scarcely or very feebly sinuate in front and behind; apex less sinuous than in *dorrigoensis*, the anterior angles less strongly produced than in this species or in *quadriplagiatus*.

Elytra obovate, very convex; lateral margins narrowly horizontal and minutely crenulate; striae-punctate, the striae shallower and the seriate punctures smaller than in *quadriplagiatus* Cart.

Prosternal process much longer and narrower than in *quadriplagiatus*, its apex almost cylindric, otherwise the underside not very dissimilar from that species.

Dimensions: 3.3 x 1.6 mm.

Habitat: New South Wales, Galston (Messrs. J. Armstrong, E. H. Zeck and H. J. Carter).

Fourteen examples have been examined. This was at first confused with the Victorian *quadriplagiatus*, but it is distinguished by rather larger size, more nitid surface, finer seriate punctures and an entirely differently shaped prosternum. The elytral plagae are much smaller, the sub-apical spots tending to disappear altogether.

*Dorrigoensis* is even more strongly differentiated by the colour of the underside, the truncate prosternal process and the markedly hooded prosternum.

Holotype in Coll. Carter.

*NOTRIOLUS HUMERALIS* sp. nov.

(Plate iv., Fig. 25.)

Widely oval, very nitid black, underside brown, elytra with large shoulder spot white, antennae and tarsi red.

Head and pronotum finely and evenly punctate; antennae fine and linear.

Prothorax uniformly convex (without transverse division), widest near middle, thence narrowing to apex and sub-sinuately to base, the latter wider than apex and sub-truncate or very feebly sinuate, sides with narrow raised border, narrowly sulcate within this, anterior angles acute, posterior obtuse; disc with short transverse fovea near base at middle.

Elytra shortly obovate (sometimes ovate), wider than prothorax at base, shoulders widely rounded, humeral callus pale, this emphasized by an oblique depression following the fifth stria; striae-punctate, the seriate punctures round and regular, intervals flat, distinctly but finely punctate. Underside very coarsely punctate throughout.

Dimensions: 3.6 x 1.8 mm.

Habitat: New South Wales, Eccleston, Allyn River; also the Williams River, at Dungog and *Dorrigo* (W. Heron).

Eighteen examples from the first and five from the second district show a distinct species, nearest in form and facies to *H. barretti* Cart. The

latter is distinguished by the absence of the shoulder spot, the sub-laevigate elytral intervals and the less coarsely punctate underside.

Type in Coll. Carter.

*N.B.*—The single specimen lately included under *H. barretti* Cart. as var. *basalis* is really *N. humeralis*.

**NOTRIOLUS SUBPLANATUS *sp. nov.***

(Plate vii., Fig. 83.)

Widely ovate, convex, nitid black, antennae and tarsi red.

Head and pronotum finely and closely punctate.

Prothorax widest at base, sides parallel for a short way, thence gently converging to apex; margins rather narrowly explanate, anterior angles lightly produced and acute; posterior sharply rectangular; basal third of disc delimited by a light transverse ridge; medio-basal area flattened. (In some examples the flattened area reduced to two shallow depressions).

Scutellum sub-triangular, sides rounded.

Elytra very convex and widely oval, sides widening from the pronotal junction, widest at middle, a narrow horizontal margin, finely serrulate behind; striae-punctate, with ten rows of small punctures in lightly defined striae, intervals flat, very minutely wrinkled, scarcely punctate.

Prosternum unevenly, not closely punctate, its process wide and widely rounded (sub-truncate) at apex, mesosternum rather coarsely punctate and channelled, abdomen opaque and finely punctate.

Dimensions: 3 x 1.5 mm. (approximately).

Habitat: Lake Barrina district, Atherton Tablelands, Queensland (Mr C. Barrett).

We are indebted to that keen naturalist and author, Mr. C. Barrett, for nine examples of this addition to the family. It is easily recognized by the combination of nitid surface, wide and convex form and the characteristic flattening of the basal area of the pronotum—this last accentuated by the transverse ridge that forms its anterior limit.

Holotype in Coll. Carter.

**NOTRIOLUS VICTORIAE *sp. nov.***

(Plate ii., Fig. 12.)

Oval moderately convex, black moderately nitid, elytra with four yellow or pale markings, two at base almost extending across elytra, two on apical declivity; antennae and tarsi red.

Head and pronotum finely and densely punctate.

Prothorax widest at posterior third, thence gradually narrowing in a curve to apex, more strongly so at base, without distinct sinuation; anterior angles advanced, deflected and acute, posterior obtuse; disc with a defined transverse depression near base.

Scutellum sub-circular.

Elytra elongate and slightly obovate, wider than prothorax at shoulders, greatest convexity at middle, margins narrowly horizontal and minutely crenulate; striae-punctate, the striae moderately deep, seriate punctures large at sides, perceptibly smaller towards suture; intervals flat, punctate and minutely and sparsely pustulose; underside coarsely punctate; pro- and mesosternum with fine pustules between the punctures; prosternal process rounded at apex, post intercoxal plate triangular.

Dimensions: 4.3 x 1.9 mm.

Habitat: Victoria, Traralgon, Tyers River (C. Barrett); Upper Yarra, also Lorne (C. Barrett); Mount Kosciusko (H. J. Carter).

Thirty examples examined, some of which had been confused with



specimens of *N. quadripilgatus* Cart. which it somewhat resembles. It is different from that species in the following characters: Size larger, less convex and less nitid, pronotum more elongate with greatest width behind the middle, elytral striae less defined, the seriate punctures much larger at sides than middle, and the elytral intervals are sub-asperate, due to the presence of minute pustules amongst the punctures. The underside contains even more definite differences as follows:—

<i>victoriae.</i>	<i>quadriplagiatus.</i>
(a) Pro- and mesosternum pustulose.	non-pustulose.
(b) Prosternal process rounded at apex.	sub-truncate at apex, its sides straighter.
(c) The punctate plate between, hind-coxae triangular.	semi-circular.
(d) Last abdominal segment longitudinally channelled.	not channelled.

It is distinguished from *maculatus* by its wider form and more nitid surface, the pronotum especially more widely rounded and explanate; the elytral basal markings sub-fasciate (in *maculatus* mere shoulder spots) with different elytral sculpture and much finer punctures of the underside. (In *maculatus* the mesosternum has coarse distant punctures).

Holotype in Coll. Carter.

*N.B.*—A var. of *maculatus* from Dorrigo, New South Wales, is without the apical maculae.

*COXELMIS* *gen. nov.*

Glabrous.

Head partially retractile; maxillary palpi 4-art.; antennae linear, long; extending at rest beyond the base of prothorax.

Pronotum sub-conic, uni- or bilobate, without sub-lateral sulcus, widest at base, sides in front deflexed and embracing prosternum; base feebly bisinuate; elytra striate-punctate, latero-apical margins entire, apices separately pointed; prosternal process short and truncate at apex; fore coxae as widely separated as the middle coxae; metasternum channelled.

Genotype: *Elmis novemnotata* King.

## Table of Species.

- |   |  |
|---|--|
| 1. Elytra having 5 to 8 linear pale markings. . . . . | 2.   |
| Elytral markings confined to humeri. . . . .          | <i>trinotata</i> n.sp.                       |
| 2. Pronotum with strong transverse sulcus. . . . .    |  |
|   | <i>v. fasciata</i> Lea. (pl. iii., fig. 21.) |
| Pronotum without transverse sulcus. . . . .           |  |
|   | <i>novemnnotata</i> King (pl. iv., fig. 30.) |

In *novemnotata* the pronotum is quite devoid of any transverse sulcus.

In *trinotata* the pronotum has a partial or lightly impressed transverse sulcus.

*COXELMIS TRINOTATA* sp. nov.

(Plate iv., Fig. 28.)

Narrowly elongate, tapering in front and behind, above nitid black, apex of pronotum red, a large shoulder spot on each elytron flavous, underside reddish brown, antennae, tarsi, knees and underside of tibiae and parts of underside red or flavous.

Head about as wide as apex of prothorax, apparently not retractile beyond a frontal ridge, eyes not prominent, antennae unusually long, fili-

form, extending beyond the base of pronotum, two basal segments stout 11th longer than the rest and lanceolate.

Prothorax sub-bilobate, narrowly elongate, the convex anterior lobe separated by a lightly impressed sinuate transverse impression, widest near the base, anterior angles unseen from above, base bisinuate, hind angles sub-acute, sides slightly rounded on posterior lobe, margins not explanate and only visible (from above) near base; disc densely covered with shallow punctures, a transverse sulcus near base.

Elytra considerably wider than prothorax at base, shoulders rounded, sides a little compressed before and feebly widened behind the middle; apices separately pointed; finely striate-punctate, intervals flat and covered with punctures and wrinkles, the punctures in the shallow striae scarcely distinguishable from the interstitial.

Prosternum coarsely punctate, its posterior process wide and truncate, meso- and metasternum successively less coarsely punctate, post-intercoxal process oval with a fringe of golden hair, abdomen finely punctate.

Dimensions: 3.3 x 1.2 mm. (approximately).

Habitat: New South Wales, Galston Gorge and Cox River, Blue Mountains (H. J. Carter).

William Ferguson, son of Dr. E. W. Ferguson, and one of us took three examples of this distinct species on January, 1927, in Galston Creek; also one taken in the Cox River, January 8th. Also sent from East Dorriggo by Mr. W. Heron.

It is near *C. novemnotata* King, but is variously distinguished by its more navicular form, the sub-bilobate pronotum, the different markings and stronger sculpture of the upper surface. Both species have separately pointed apices and unusually long antennae.

Holotype in Coll. Carter.

*Cozelmis* (*Elmis*) *v-fasciata* Lea. Mr. Lea has courteously supplied us with a slightly damaged co-type, besides lending us, later, a second example in good condition. Amongst our very long series of *C. novemnotata* King, we find four examples which agree with Lea's species, except in their darker colour—especially of the underside; and the less distinct, though similar, pattern of the elytra. As this pattern is extremely variable in *novemnotata* (in one example the elytra are without any pale lines) we consider these four as slight variations of the typical Tamworth species.

*Helmis pallidipes* Cart. is clearly a *Stenelmis* (pl. II., fig. 9).

#### NEOSOLUS gen. nov.

Elliptic, head retractile, antennae filiform, 11-segmented, the two basal segments slightly widened, the apical pointed and about twice as long as the tenth.

Pronotum sub-oblong, apex convex and produced in middle, sides nearly straight, anterior angles declinate; disc with a moderately deep medial sulcus, and a sub-lateral carina extending throughout parallel to the sides.

Scutellum oval and convex.

Elytra with sub-lateral carina similar to the pronotal and continuous with it; disc with lightly defined sculpture and a sub-granulose, shagreened surface.

Prosternum moderately long, its hind process bluntly rounded, metasternum with short medial carina at bottom of a longitudinal depression. Legs moderately long, fore tibiae without tomentum.

In general form like *Esolus*, but its strongly channelled pronotum, different scutellum and elytral sculpture distinguish it. From *Austrolimnius* it differs in its narrower form, the sub-quadrate prothorax and the

granulose elytra with indistinct seriate punctures. We have not been able to see clearly the articulation of the palpi.

Genotype: *N. tropicus* Cart.

*NEOSOLUS TROPICUS* sp. nov.

(Plate vi., Fig. 77.)

Ovate, opaque black, apex of pronotum, antennae, tibiae and tarsi pale red.

Head vertical, narrower than apex of prothorax, antennae filiform, not enlarged apically, the 11th segment finely pointed.

Prothorax sub-quadrate, a little narrowed and bent down at apex, anterior angles unseen from above, posterior sub-rectangular, base sub-truncate (very feebly sinuate), sides nearly straight on posterior half, slightly converging to apex; medial sulcus deep, extending to basal, but not quite to apical margin; sub-explanate margins with well defined carina on inside; extreme border as seen from below, minutely serrate; disc minutely granulose.

Scutellum oval, raised and nitid.

Elytra oval, scarcely enlarged behind middle, of same width as prothorax at junction, soon widening behind this, rather bluntly narrowed at apex, extreme border (only as seen from below) minutely serrulate; with two fine lateral ridges; a longitudinal carina continuous with pronotal carina, soon broken up into a line of granules, these indistinct towards apex; between this and suture two shallow, wide ill-defined striae, the outer one (at least) bordered by a row of granules; general surface rough, sub-granulose. Underside rather strongly granulose, the planate medial area more coarsely so than the exterior parts.

Dimensions: 1 mm. long.

Habitat: Northern Territory, Adelaide River (British Museum).

Var. *asper* (pl. vi., fig. 80).

One example differs from the other two in the stouter antennae and the more roughly sculptured surface of pronotum and elytra. The quite strongly serrulate margins of these are evident from above; the two medial elytral carinae, one on each elytron, are less broken up (continuous at least on basal half) the space between these and suture containing a longitudinal depression on each side of suture, the sub-sutural surface transversely wrinkled.

An examination of further material will probably show this to be a distinct species.

The minute size (little more than half the length of *A. politus* or *A. victoriae*, the opaque surface and narrower form easily distinguish this species.

Type series: Two on card and variety in the British Museum.

Dryopidae taken during the last week of October, 1926, in the Allyn, Williams, Paterson, and Barrington Rivers and Massie's Creek, Eccleston district, N.S.W.

*Hydrethus australis* King, *Stetholus elongatus* n.sp., *Austrolimnius montanus* King, *A. politus* King, *Kingolus cupreus* Cart., *K. flavoplagiatus* sp. nov., *K. flavosignatus* sp. nov., *Simsonia hopsoni* sp. nov., *K. metallicus* King, *K. quatuormaculatus* King, *K. tinctus* sp. nov., *K. tyrrenus* sp. nov., *Simsonia irregularis* sp. nov., *S. leai* sp. nov., *S. purpurea* Cart., *Notriolus allynensis* Cart., *N. barretti* Cart., *N. humeralis* sp. nov., *N. maculatus* Cart., *Coelmis novemnotata* King, *C. v. fasciata* Lea, var.

N.B.—Massie's Creek joins the Allyn River at Eccleston. The Allyn flows into the Paterson, while both the Paterson and Williams are tributaries of the Hunter River. The Barrington is an affluent of the Manning River [Vide Sloane's map in Proc. Linn. Soc. N.S.W., 1916, p. 197].

#### CHECK LIST OF AUSTRALIAN DRYOPIDAE.

##### Sub-family DRYOPINAE.

*Hydrethus (Lutochrus) australis* King, Trans. Ent. Soc. N.S.W., 1865, 159.  
*H. leai* Cart., Proc. Linn. Soc. N.S.W., 1926, 64.

##### Sub-family HELMINAE.

*Austrolimnius luridus* n.sp.  
*Austrolimnius (Elmis) montanus* King, Trans. Ent. Soc. N.S.W., 1865, 160.  
*A. (Elmis) politus* King, l.c., 160.  
*A. victoriensis*, sp. nov.  
*Stenelmis (Helmis) pallidipes* Cart., Proc. Linn. Soc. N.S.W., 1926, 63.  
*Kingolus (Helmis) aeratus* Cart., l.c., 62.  
*K. cupreus* Cart., l.c., 507.  
*K. flavoplagiatus*, sp. nov.  
*K. flavosignatus*, sp. nov.  
*K. heroni*, sp. nov.  
*K. (Elmis) metallicus* King, Trans. Ent. Soc. N.S.W., 1865, 160.  
*K. (Limnius) quattuormaculatus* King, l.c., 101.  
*K. tinctus*, sp. nov.  
*K. tyrrenus*, sp. nov.  
*K. yarrensis*, sp. nov.  
*Simsonia (Helmis) angusta* Cart., Proc. Linn. Soc. N.S.W., 1926, 62.  
*S. hopsoni*, sp. nov.  
*S. irregularis*, sp. nov.  
*S. leai*, sp. nov.  
*S. (Helmis) nicholsoni* Cart., Proc. Linn. Soc. N.S.W., 1926, 61.  
*S. (Helmis) purpurea* Cart., l.c., 508.  
*S. (Elmis) tasmanica* Blkb., l.c., 1894, 94.  
*S. vestita*, sp. nov.  
*S. (Helmis) wilsoni* Cart., Proc. Linn. Soc. N.S.W., 1926, 64.  
*Notriolus (Helmis) allynensis* Cart., l.c., 61.  
*N. (Helmis) barretti* Cart., l.c., 506.  
*N. dorrigensis*, sp. nov.  
*N. galstonensis*, sp. nov.  
*N. humeralis*, sp. nov.  
*N. (Helmis) maculatus* Cart., Proc. Linn. Soc. N.S.W., 1926, 507.  
*N. (Helmis) quadriplagiatus* Cart., l.c., 63.  
*N. (Helmis) simsoni* Grouv., Not. Leyd. Mus., 1896, 49.  
*N. subplanatus*, sp. nov.  
*N. victoriae*, sp. nov.  
*Corelmis (Elmis) novemnotata* King, Trans. Ent. Soc. N.S.W., 1865, 159.  
*C. trinitata*, sp. nov.  
*C. (Elmis) V. fasciata* Lea, Proc. Linn. Soc. N.S.W., 1894, 590.  
*Neosolus tropicus*, gen. et sp. nov., var. *asper*.  
*Stetholus elongatus*, gen. et sp. nov.



## EXPLANATION OF PLATES.

## Plate I.

- |  |  |
|--|--|
| 1. <i>Kingolus flavosignatus</i> .                   | 5. <i>Kingolus quattuormaculatus</i> . |
| 2. <i>Kingolus</i> ( <i>Simsonia</i> ) <i>leai</i> . | 6. <i>Kingolus tyrrhenus</i> .         |
| 3. <i>Kingolus flavoplagiatus</i> .                  | 7. <i>Kingolus tinctus</i> .           |
| 4. <i>Kingolus cupreus</i> .                         | 8. <i>Kingolus metallicus</i> .        |

## Plate II.

- |   |                                    |
|---|------------------------------------|
| 9. <i>Stenelmis pallidipes</i> .        | 13. <i>Simsonia angusta</i> .      |
| 10. <i>Austrolimnius victoriensis</i> . | 14. <i>Simsonia irregularis</i> .  |
| 11. <i>Austrolimnius montana</i> .      | 15. <i>Austrolimnius politus</i> . |
| 12. <i>Notriolus victoriae</i> .        | 16. <i>Stetholus elongatus</i> .   |

## Plate III.

- |                                  |                                  |
|----------------------------------|----------------------------------|
| 17. <i>Hydrethus australis</i> . | 21. <i>Cozelmis V-fasciata</i> . |
| 18. <i>Simsonia tasmanica</i> .  | 22. <i>Simsonia purpurea</i> .   |
| 19. <i>Simsonia vestita</i> .    | 23. <i>Simsonia nicholsoni</i> . |
| 20. <i>Simsonia wilsoni</i> .    | 24. <i>Simsonia hopsoni</i> .    |

## Plate IV.

- |                                   |  |
|-----------------------------------|--|
| 25. <i>Notriolus humeralis</i> .  | 29. <i>Notriolus quadriplagiatus</i> . |
| 26. <i>Notriolus maculatus</i> .  | 30. <i>Cozelmis novemnotata</i> .      |
| 27. <i>Notriolus allynensis</i> . | 31. <i>Notriolus barretti</i> .        |
| 28. <i>Cozelmis trinotata</i> .   | 32. <i>Notriolus simsoni</i> .         |

## Plate V.

Sternal processes, magnified 42 diameters.

- |   |  |
|---|--|
| 33. <i>Hydrethus australis</i> .              | 54. <i>Simsonia tasmanica</i> .            |
| 34. <i>Austrolimnius politus</i> .            | 55. <i>Simsonia nicholsoni</i> .           |
| 35. <i>Austrolimnius luridus</i> .            | 56. <i>Simsonia vestita</i> .              |
| 36. <i>Austrolimnius victoriensis</i> .       | 57. <i>Simsonia irregularis</i> .          |
| 37. <i>Austrolimnius montanus</i> .           | 58. <i>Notriolus humeralis</i> .           |
| 38. <i>Kingolus flavosignatus</i> .           | 59. <i>Notriolus victoriae</i> .           |
| 39. <i>Stenelmis pallidipes</i> .             | 60. <i>Notriolus barretti</i> .            |
| 40. <i>Kingolus heroni</i> .                  | 61. <i>Notriolus barretti, var.</i>        |
| 41. <i>Kingolus aeratus</i> .                 | 62. <i>Notriolus dorrigoensis, var.</i>    |
| 42. <i>Kingolus cupreus</i> .                 | 63. <i>Notriolus quadriplagiatus</i> .     |
| 43. <i>Kingolus flavoplagiatus</i> .          | 64. <i>Notriolus maculatus</i> .           |
| 44. <i>Kingolus metallicus</i> .              | 65. <i>Notriolus allynensis</i> .          |
| 45. <i>Simsonia leai</i> .                    | 66. <i>Notriolus simsoni</i> .             |
| 46. <i>Kingolus tinctus</i> .                 | 67. <i>Notriolus subplanatus</i> .         |
| 47. <i>Kingolus quattuormaculatus</i> .       | 68. <i>Cozelmis novemnotata</i> .          |
| 48. <i>Kingolus tyrrhenus</i> .               | 69. <i>Cozelmis trinotata</i> .            |
| 49. <i>Simsonia wilsoni</i> .                 | 70. <i>Cozelmis trinotata</i> .            |
| 50. <i>Simsonia purpurea</i> .                | 71. <i>Cozelmis V-fasciata</i> .           |
| 51. <i>Simsonia angusta</i> .                 | 72. <i>Neosolus tropicus</i> .             |
| 52. <i>Simsonia, sp.n. (? purpurea, var.)</i> | 73. <i>Stetholus elongatus</i> .           |
| 53. <i>Simsonia hopsoni</i> .                 | 74. <i>Neosolus tropicus, var. asper</i> . |

## Plate VI.

- |                                |  |
|--------------------------------|--|
| 75. <i>Kingolus heroni</i> .   | 78. <i>Austrolimnius luridus</i> .               |
| 76. <i>Kingolus aeratus</i> .  | 79. <i>Kingolus yarrensis</i> .                  |
| 77. <i>Neosolus tropicus</i> . | 80. <i>Neosolus tropicus</i> var. <i>asper</i> . |

## Plate VII.

81. *Notriolus dorrigoensis*.
82. *Notriolus galstonius*.
83. *Notriolus subplanatus*.
84. Sternal process of *Notriolus dorrigoensis*. x 56.
85. Sternal process of *Notriolus galstonius*. x 56.
86. Sternal process of *Kingolus aeratus*. x 56.
87. Sternal process of *Kingolus yarrensis*. x 56.
88. Antenna of *Stetholus elongatus*. x 50.
89. Antenna of *Corelmis trinotatus*. x 50.
90. Antenna of *Hydrethus australis*. x 50.
91. Antenna of *Simsonia vestita*. x 50.
92. Antenna of *Austrolimnius politus*. x 50.
93. Antenna of *Kingolus metallicus*. x 50.
94. Middle tibia of male *Austrolimnius victoriensis*.
95. Maxillary palpus of *Kingolus metallicus*.
96. Maxillary palpus of *Austrolimnius politus*.

## COLOUR AND ITS REPRODUCTION FOR LANTERN SLIDES.

By A. A. LAWSON.

(An abstract of an illustrated lecture delivered at a meeting of the Ornithological Section.)

Plate viii.

To a French investigator must be ascribed the credit of the earliest discovery of a method for the reproduction of a multicolour subject by what is now commonly known as the three-colour process, using photographic colour separation negatives.

Ducos du Hauron was born in the Gironde Province in 1837. When he was thirty years old he was the first to announce and describe in detail the principles and method of three-colour separation and reproduction by photographic means which form the basis of the methods in employment at the present day. Consideration of other inventions attributed to him, amongst which was one of a form of cinematograph, indicates that he was the possessor of a singularly original and versatile mind.

That du Hauron died in his native town only nine years ago at the age of eighty-three and in extreme poverty is a melancholy reflection. He is surely entitled to an honoured place amongst that noble company of unrequited pioneers who pass on, leaving an apparently thoughtless world so heavily a debtor.

The example of colour separation and reproduction which I desire to bring under notice entails the employment of the principles which were discovered by du Hauron. These rely upon the assumption that every tint and shade in the solar spectrum is the result of admixture in varying proportions of the three primary colours, red, blue and yellow. By means of what are known as colour filters it is possible to eliminate any given primary colour in a multicolour subject. By the employment of one of a blue-green shade red, to whatever extent it appears either in full strength or in blend, is eliminated and appears on a photographic negative as clear glass, or partially so, according to its strength in the original. Similarly a blue filter eliminates yellow and a red filter eliminates blue. Therefore by interposing a filter of appropriate colour between the subject being photographed and the photographic plate, we can secure a negative which renders one of the primary colours in the original as clear glass or partially so, according to its strength in the original. It must be noted that for all colour rendering, by photographic means, a special plate must be used which is sensitive, in balanced proportion, to the three primary colours. The ordinary photographic plate is not so and is quite useless for colour separation.

By the means described we may secure one negative capable of yielding a print which represents all of the red in a multicolour subject, one which represents all of the blue and one which represents all of the yellow, in precise ratio to the extent to which each of these colours appears in the original. It follows that if we can print these three impressions, each in its respective colour, we must reproduce the colours as they appear in the original. So far we have followed the principles of du Hauron.

To secure prints for the purpose immediately in view I adopt a principle discovered by a British chemist named Ponton, so far back as 1839. This relates to a peculiar property possessed by the bichromates of both potash and ammonia. He found that the addition of either of these to any of the colloids, such as glue or gelatine, affected their solubility under the

influence of light. This principle enables me to secure a print from each of the three negatives, each in its respective colour, and which in combination will reproduce all of the colours of the original.

To a proportion of gelatine in solution I add a colouring pigment calculated to represent the eliminated colour in my first negative. I carefully coat the paper, taking pains to secure an even level coating. This is put aside to dry. Next the bichromate, preferably potash which is the sensitiser, is prepared. This solution is applied to the gelatine coated paper either by careful swabbing or, preferably, floating in a dish. The now sensitised paper should be placed in the darkroom to dry. Paper is prepared similarly of the other two colours and duly sensitised. I have now a series of papers calculated to represent, when printed, under each of the three separation negatives, the correct proportions in which each of the three primary colours appears in the original. Printing is proceeded with in the usual manner, excepting, that as it is impossible to see any image, length of exposure must be determined by experience or by the use of an actinometer. When exposure is deemed to have been sufficient the prints are placed in cold water to become soft and flaccid.

As the objective is to produce a transparency in colour suitable for use in an optical lantern, I adopt thin sheet celluloid as the most suitable support for the gelatine prints. It must be remembered that as these prints have been exposed with their faces to the light their development, or the removal of the soluble gelatine, must be attacked from the back. This is attained by securing the print, face down, upon the celluloid support by slipping the latter under the soft print as it lies face down in the dish and removing both together from the water. Care must be taken that adhesion is perfect and that no air bells intervene. A flat squeegee smoothly passed over the back of the print will expel the water, exclude the air and secure the print firmly to the support. Placing between sheets of pure blotting paper and under a slight weight will expedite drying. When partially dry the print, upon its celluloid support, is placed in a dish of warm water for development. As soon as the heated water has soaked through the paper backing the soluble gelatine will be noticed exuding at the edges. If this does not occur in a very few minutes the temperature may be raised by adding hot water. Presently it will be found possible to gently raise a corner of the paper backing. Softening of the gelatine will gradually proceed until the point is reached when the entire paper backing may be stripped off leaving the insoluble gelatine image on the support together with much unwanted soluble gelatine. Laving with warm water is continued until it is considered that all of the soluble gelatine has been washed away. When this stage has been reached the picture, or at least one of its component colours upon its support, will have been secured, and the operator enabled to see whether it is as it should be, or, if not, where he has gone wrong. The two remaining prints are dealt with in a precisely similar manner.

Nothing now remains but to assemble the three developed prints and trim their edges in such a manner that they will be square and of the proper lantern slide size, but above all ensuring that the three prints register correctly as to the subject. Upon this latter depends the success of the picture when exhibited in greatly enlarged scale by the optical lantern. It is very advisable that the assembled prints be covered for their protection on both sides by the customary thin lantern slide glasses.

In conclusion, I would say that this process is capable of yielding highly attractive and artistic results and, if reliable pigments are used in the gelatine, prints are absolutely permanent.



## THE LORICATES OF THE NEOZELANIC REGION.

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### I. (Continued.)

#### ISCHNOCHITON CIRCUMVALLATUS.

Plate ix., fig. 1.

1929. *Ischnochiton circumvallatus* Iredale and Hull, Austr. Zool., v., 316, pl. xxxiv., figs. 7-9.

At the place cited the history of this species was related and an immature specimen was figured. The adult is now pictured from a co-type of *Ischnochiton campbelli* Filhol = *Lepidopleurus melanterus* Rochebrune from Campbell Island (presented to one of us by Mr. Edwin Ashby ex Dupuis collection). This is a little larger than the majority of "*fulvus*" shells, but otherwise no distinction has been recognised.

### II. Family LEPIDOPLEURIDAE.

This family is used to include Loricates which have lost the slitting of the insertion plates of the valves, or even the plates themselves. It is at present a heterogeneous assemblage, as proved by the radular characters, an item of some importance in this group. The mere fact that so-called Lepidopleurids provide distinctive styles of odontophore indicates the polyphyletic nature of the so-called family. Study of the members of the family further confirm this obvious conclusion, as they are found associated with such conditions that would allow the degeneration of the insertion plates through disuse. A comparison of such a Loricata as *Lepidopleurus cajetanus* Poli with (say) *Parachiton puppis* Hull would satisfy any student on this point. We have already recorded the intermediate stages in more than one family and will give full details of another (*Hemiarthrum*) in this work.

Shells of varying sizes, mostly small, of delicate texture (through their habitat) and scaly or spiculose girdle. Sculpture usually obsolete, pustulation rarely developing into strong radiation. Girdle covered with small scales or glassy spicules. Insertion plates generally missing in all valves; sutural laminae present, but reduced to small size.

It may be observed that the type of the genus *Lepidopleurus* is a rather heavy crass shell, very unlike any of the southern shells.

The Neozelanic forms can be separated into two genera as:—

Shell small with posterior valve normal; girdle scaly. . . . *Terenochiton*.  
Shell larger with posterior valve generally disproportionately large; girdle clothed with glassy spicules. . . . . *Parachiton*.

Recently it has been suggested that as there is a minute spiculose edge to a scaly girdle these cannot be easily distinguished, but the youngest student should find no difficulty in this case.

#### ii. Genus TERENOCHITON.

1914. *Terenochiton* Iredale, Proc. Mal. Soc., xi. (March), 28. Type by original designation *Lepidopleurus subtropicalis* Iredale.

Shells of small size for the family (the smallest Neozelanic Loricates)

mostly unicolour, more or less elevated, elliptic ovals; sculpture consisting of minute distinct pustules, sometimes forming bead-like strings on central areas, commonly massed into rays on end valves. Girdle scales small, oval, striate.

Insertion plates absent throughout, but small distinct triangular sutural laminae present.

The curious station of the Kermadec type, under deeply buried stones between tide marks, has been confirmed by the collecting of the Sydney species (*badius*) at Long Reef, near Manly, N.S.W., of sixty to eighty specimens in one afternoon, under similar conditions.

#### 7. TERENOCHITON INQUINATUS.

Plate ix., figs. 3-6.

1847. *Chiton inquinatus* Reeve, Conch. Icon., iv., pl. xxiii., sp. and fig. 154, (May). "Van Dieman's Land, Dr. Sinclair" error = New Zealand, we designate Auckland Harbour, North Island. Type in British Museum.
1892. *Ischnochiton inquinatus* Pilsbry, Man. Conch., xiv., 90, pl. xviii., figs. 49-50. Reeve's figures copied.
1896. *Lepidopleurus inquinatus* Pilsbry, Nautilus, ix., 108, January.
1897. *Lepidopleurus inquinatus* Suter, Proc. Mal. Soc., ii., 184, July.
1904. *Lepidopleurus inquinatus* (sic) Hutton, Index Faunae New Zeal., 87.
1905. *Lepidopleurus inquinatus* Hamilton, Col. Mus. Bulletin, No. 1, 36.
1913. *Lepidopleurus inquinatus* Suter, Man. N.Z. Moll., 7. Atlas: pl. 2, fig. 1; pl. 3, fig. 1.
1915. *Lepidopleurus inquinatus* Iredale, Trans. N.Z. Inst., xlvii., 1914, 423.
1921. *Lepidopleurus iredalei* Ashby, Proc. Roy. Soc. Vict., xxxiii., n.s., 155-7, pl. viii., fig. 3 a-b., May. Doubtless Bay, North Island, N.Z.
1923. *Lepidopleurus iredalei* Oliver, Trans. N.Z. Inst., liv., 1922, 529. Auckland Harbour.
1923. *Lepidopleurus iredalei* Finlay, Rep. Austr. Ass. Adv. Sci., xvi., 342.
1923. *Lepidopleurus inquinatus* Ashby, Trans. Roy. Soc., S.A., xlvii., 217 (corrects his error).
1924. *Lepidopleurus inquinatus* Odhner, Vidensk. Medd. Dansk. Nat. Foren. Bd. 77 (N.Z. Moll.), 5, fig. 1.
1926. *Lepidopleurus inquinatus* Finlay, Trans. N.Z. Inst., lvii., 331.

Reeve's description reads as follows: "Shell oblong-ovate, terminal valves and lateral areas of the rest concentrically somewhat obscurely ribbed, faintly radiately grooved, central areas longitudinally finely ridged, ligament horny, arenaceous; whitish, stained with a light brown spot along the summit of each valve.

"Habitat: Van Dieman's Land (Dr. Sinclair).

"The shell is sometimes partially stained throughout with the faint brown colour, which appears on the umbonal summit."

The re-discovery of the group of Loricates of which the present species is the commonest representative took place simultaneously in New Zealand and Australia nearly fifty years after the above description by Reeve. The species inhabiting the two localities were not differentiated at the time, but when Iredale compared the type series in the British Museum with Neozelanic specimens, they were found to agree exactly, while no Tasmanian shells could be found corresponding; it thus became obvious that the shells had been collected in New Zealand by Dr. Sinclair, as he collected more material there than in Tasmania, while the other Loricates he found in New Zealand were also localised incorrectly.

Ignoring this conclusion, based upon irrefutable data, Ashby described the New Zealand species as *Lepidopleurus iredalei* as follows: "*L. iredalei* differs from *L. inquinatus* Reeve, in that the girdle is clothed with comparatively large, flattened, irregular scales, quite different from the Tasmanian shell, in which species the scales are like minute, irregular grains of sand. In common with the other species, the girdle is furnished with a spiculose fringe, but in some of the specimens before me the girdle is almost otherwise bare of spicules. The latter (N.Z.) is more rounded than the Tasmanian, and the polished appearance is more persistent. The dark specimens vary from liver brown to hazel, and the lighter colour in the paler forms is cinnamon. Largest: 14 x 7 mm.; type, 8 x 4½; from Doubtless Bay, New Zealand."

Later, examining the type series in the British Museum, Ashby recognised his error and confirmed Iredale's conclusion. There are many species lumped at present under the name *inquinatus*, as Suter has recorded it from "25 fathoms, Hauraki Gulf," an impossible station for this littoral form. Odhner has remarked: "There is some variation in the sculpture in this species, the grains being somewhat larger than usual, by which their lateral arrangement at the later areas may be less distinct on account of their crowded disposition; this is obvious in the specimen from Campbell Island (fig. 1)."

Iredale observed years ago that probably more than one species was confused under the name "*inquinatus*," and one he had under observation is here described, but there may be many more.

8. *TERENOCHITON OTAGOENSIS* sp. nov.

Plate ix., fig. 11.

Shell very small, elongate oval, elevated, semi-keeled, side slopes curved, girdle scaly.

Colour reddish-buff, darker medially.

Sculpture consists of minute pustules, rayed on end valves, and lateral areas of median valves, and forming strings longitudinally on the pleural areas. On the anterior valve fifty closely packed radials may be counted and about forty on the post-mucronal area of the posterior valve; twelve radials are visible on the lateral areas, while about fifteen longitudinal chains of pustules are easily seen on each side of the jugum, closer packed jugally and widely raying laterally.

The mucro is at the anterior third, the post-mucronal slope a little concave.

Girdle scales minute, oval, striate.

Dimensions: Length, 7 mm.; breadth, 3.5 mm. (type).

Habitat: Otago, New Zealand. Type collected near Cape Saunders, shell also procured at Shag Point.

Station: Under stones just below high water mark.

Easily separated by its smaller size and bolder sculpture, the shells being worn and senile at the size given above.

9. *TERENOCHITON NORFOLCENSIS*.

Plate ix., figs. 7-10.

1912. *Lepidopleurus norfolcensis* Hedley and Hull, Proc. Linn. Soc. N.S.W., xxxvii., 273, pl. xi., figs. 1a-c. Norfolk Island. Type in Australian Museum.

The original description reads: "Shell small, elongated, low. Colour buff.

"Anterior valve ornamented by radial and concentric rows of small, close pustules, increasing in size and spacing toward the margin.

"Posterior valve: Mucro prominent, central; posterior slope even; clothed with close concentric rows of pustules.

"Median valves: Lateral areas slightly raised, not distinctly differentiated. The pustules on the central areas are inclined to longitudinal arrangement; those on the lateral areas are more transverse.

"Girdle broad, beset with small scales and spicules, the latter developing a marginal fringe. Length: 6 mm.; breadth, 3.5 mm.

"Station: Under loose stones at low tide.

"Habitat: Norfolk Island.

"Remarks: This shell is not common. It differs from the Australian species *L. badius* Hedley and Hull, in the more regular arrangement and larger size of the pustules."

#### 10. *TERENOCHITON CATENATUS*.

Plate ix., figs. 12-15.

1912. *Lepidopleurus catenatus* Hedley and Hull, Proc. Linn. Soc. N.S.W., xxxvii., 273, pl. xi., figs. 2a-c. Lord Howe Island. Type in Australian Museum.

Originally described thus: "Shell small, elongated, low. Colour cream.

"Anterior valve with numerous rows of pustules, arranged radially and connected by short links, giving the appearance of concentric rings. The posterior margins raised, and more densely and irregularly pustulose.

"Posterior valve: Mucro prominent, slightly behind the middle, the anterior half sculptured, with longitudinal rows of pustules; the posterior half with radial rows.

"Median valves: Lateral areas raised posteriorly; latero-pleural areas sculptured, with 12-14 longitudinal rows of rounded pustules connected each to its fellow in the neighbouring row by low, slight, transverse links. On the central areas the rows are straight and set closer together, becoming increasingly concave to the axis as they recede.

"Girdle narrow, beset with minute scales.

"Length: 4.5 mm.; breadth, 2.5 mm.

"Station: On the under side of smooth stones.

"Habitat: Lord Howe Island.

"Remarks: This shell is rare and local, only one colony of five or six specimens being taken on a piece of basalt shingle in an open channel in the rocks at Ned's Beach, on the eastern side of the island. It is unlike any of the Australian or New Zealand species of the genus, and is remarkable for its prominent sculpture, and the curious differentiation in the arrangement of pustules on the posterior valve."

#### 11. *TERENOCHITON SUBTROPICALIS*.

Plate ix., figs. 16-17.

1914. *Lepidopleurus* (*Terenochiton* n.) *subtropicalis* Iredale, Proc. Mal. Soc., xi., 28, pl. ii., figs. 10-17, March. Sunday Island, Kermadec Group. Type in Canterbury Museum, Christchurch, New Zealand.

1915. *Lepidopleurus subtropicalis* Oliver, Trans. N.Z. Inst., xlvii., 1914, 557, July 12, 1915.

Completely described at its introduction as follows: "Shell small, elongate oval, highly keeled, side slopes straight and steep, girdle scaly. General coloration uniform, pale reddish-yellow to brick; two specimens blackish-brown. Anterior valve flattened, with the apex elevated and slightly re-



curved, the anterior slope being faintly concave; the sculpture consists of minute pustules, arranged in very close radial rows. Median valves have their lateral edges almost straight, but somewhat raised; the sculpture of the lateral areas, which are differentiated by a slight fold, is simply pustulose, with no defined arrangement; the pleural areas are sculptured with slanting longitudinal rows of separated tubercles; from the edge of the valve ten rows can be counted before they become ill-defined and merging on the dorsal area. Posterior valve small, with the mucro anterior and elevated, the lateral slope concave. Sculpture as in the median valves. Inside coloration white. Insertion-plates absent. Sutural laminae low and broad, higher towards the outer edges of the valves, sinus broad. Girdle densely covered with minute striated scales.

"The preceding description is drawn up from a medium-sized specimen, selected as type. Minute juvenile specimens show the anterior valve, lateral areas of median valves, and posterior area of posterior valve to be simply pustulose, without any defined arrangement of the pustules, whilst the pleural areas of the median valves are sculptured with few well-defined longitudinal rows of tubercles, and the dorsal area is almost smooth. In an old crassate individual the pustules have developed into raised tubercles upon the anterior and posterior valves, and the dorsal area is strongly irregularly tuberculose, the longitudinal rows of the pleural areas showing indistinctly through the strong tubercles massing and somewhat merging.

"Length of type: 6.5, breadth, 4; size of largest specimen, 8 x 4.5 mm.

"Habitat: Sunday Island, Kermadec Group.

"Station: Living on the underside of embedded dirty stones below low water mark.

"Remarks: This little species recalls *Lorica* in miniature, and cannot well be confused with any other Australasian chiton. Its nearest relations are *Lepidopleurus norfolcensis* Hedley and Hull, from Norfolk Island, and *L. catenatus* Hedley and Hull, from Lord Howe Island. The authors note the relationship of the latter, but do not compare the former, which they contrast with the New South Wales *L. badius* Hedley and Hull. With the type of *Lepidopleurus* these small species have nothing in common save the absence of insertion plates. I am, therefore, introducing the new sub-generic name *Terenochiton*, with *L. subtropicalis* Iredale, as type, and would for the present include all the small Australasian '*Lepidopleurus*' under this heading, though I can see little direct affinity between the present species and the Neozelanic *L. inquinatus* Reeve."

## 12. *TERENOCHITON FAIRCHILDII* sp. nov.

Plate ix., figs. 18-19.

1916. *Lepidopleurus kerguelenensis* Hedley, Austr. Antarc. Exped., 1911-14; Sci. Rep. Ser. C. Zool., iv., 34, November 6. Macquarie Island.  
 Not *L. kerguelenensis* Haddon, Rep. Chall. Zool., xv., 1886, pt. xliii., p. 12, pl. i., fig. 3; pl. ii., figs. 3a-e.  
 1926. *Lepidopleurus kerguelenensis* Finlay, Trans. N.Z. Inst., lvii., 332. Hedley's determination queried.

Shell small, narrowly elongate oval, elevated, rather keeled, girdle scaly.

Colour pink.

Sculpture obsolete, surface matt, practically smooth save for fine growth lines; many black specks (? eyes) occur all over; lateral areas little raised; anterior valve with half a dozen concentric growth lines, faint punctulation being noted with a strong lens towards the edge; mucro of pos-

terior valve ante-median, post-mucronal slope a little concave and here again a slight punctulation is preserved.

Girdle scales small.

Dimensions: Length, 8 mm.; breadth, 4 mm. (type).

Habitat: Macquarie Island.

Station: Under stones.

Type in the Australian Museum.

This delightful little species is named after Captain Fairchild, of the New Zealand Government steamer, who made large collections of natural history objects, and who probably secured some of the rare species of Loricates about fifty years ago. As this species was recorded as *L. kerquelenensis* Haddon, the description of that species is here added to emphasise the distinction: "*Shell*: Minute, smooth, or with scattered minute tubercles; the sides meet at an angle of about 100 deg., sutural laminae small, triangular. *Anterior valve*: Small, smooth, with scattered aborted tubercles. *Intermediate valves*: Central area smooth, with very faint longitudinal striae; lateral areas scarcely discernible, with faint radial striae and minute concentric interrupted ridges towards the apex, which pass into inconspicuous small scattered tubercles. *Posterior valve*: With full rounded umbo, behind which is a shallow depression. *Anterior area*: Similar to the central areas of the intermediate valves. *Posterior area*: Similar to the anterior valve. *Girdle*: Narrow, with delicate scales. *Colour*: Uniform whitish. *Size*: Length, 3 mm.; breadth, 1.5 mm. *Gills*: Posterior, eight or nine in number."

The size, 3 mm., and the tuberculose nature of the valves at that size indicate a very different mature species from that we have described, and Haddon's figures show no close likeness to our species.

### iii. Genus PARACHITON.

1909. *Parachiton* Thiele, Revision Chitonon (Chun's Zoologica, heft 56), pt. i., 1909, 14. Type by monotypy *Lepidopleurus* (*Parachiton*) *acuminatus* Thiele.

Shell elongately ovate, round-backed, of delicate texture, usually unicolour; median valves deep, posterior valve very large, generally abnormally long with the mucro subterminal; the surface sculpture consists of pustules like that of the preceding genus, but much less pronounced. Girdle covered with fine elongated glassy spicules. Interior of the valves shows no insertion plates and small sutural laminae. Thiele, when he introduced *Parachiton*, showed that the radula distinctly separated his group from that of *Lepidopleurus*, and the obvious conclusion was that the likeness was due to convergence through loss of insertion plates. The genus is widely spread in Austral-Neozelanic waters, a species as yet undescribed being dredged in the north of New Zealand by Scott's Antarctic Expedition years ago.

### 13. PARACHITON MESTAYERAE.

Plate ix., fig. 20.

1914. *Parachiton mestayerae* Iredale, Proc. Mal. Soc., ix., 27, pl. 1., fig. 1 (March). Sunday Island, Kermadec Group. Type in Canterbury Museum, Christchurch, New Zealand.
1915. *Parachiton mestayerae* Oliver, Trans. N.Z. Inst., xlvii., 1914, 557, July 12, 1915.

Again the original description is sufficiently elaborated: "*Shell* elongate, faintly keeled, elevated, side slopes slightly convex, *last valve disproportionately large*, girdle spiculose. General coloration pink, slashed

with longitudinal white streaks. Anterior valve regularly quincuncially punctate. Median valves narrow, not beaked, first very slightly larger than the others; lateral areas little raised, the sculpture regular, quincuncial punctation, the pleural areas are closely longitudinally striate, the striation becoming finer as it approaches the dorsal ridge, where, however, it still persists. Posterior valve much larger than the anterior valve; the mucro elevated at about the posterior fourth, the posterior area being concave. The anterior portion is triangular, its length twice as long as the preceding valve; it is similarly sculptured to the pleural areas of the median valves, whilst the posterior area is regularly quincuncially punctate, the punctation showing clearly on account of the protection afforded by the concavity of this area. Inside coloration pinkish-white. Insertion plates absent. The sutural laminae small, irregularly quadrangular, and very far apart. The girdle, owing to the difficulty of preserving, appears somewhat imperfectly covered with very slender elongate needles, with a fringe of much longer silvery spicules. A minute curled juvenile specimen shows the same sculpture as the adult; the quincuncial punctation appears more prominently, and the longitudinal striae more pronounced.

"Length of type: 11 mm.; breadth, 6 mm. A much larger specimen curled up before it could be preserved.

"Habitat: Sunday Island, Kermadec Group.

"Station: Dredged off the north coast on gravelly bottom in 15 fathoms; also in Denham Bay in 25 fathoms."

"Remarks: This is undoubtedly most nearly allied to *Lepidopleurus acuminatus* Thiele, but otherwise no other shell is comparable. *L. acuminatus* Thiele has the apex of the posterior valve more posterior, and consequently the posterior area more diminished. I have associated with this beautiful chiton the name of my friend, Miss M. K. Mestayer, as a mark of her interest in this group."

\* Oliver has added: "Also living on underside of stones near low water mark, Coral Bay."

### III. Family LEPIDOCHITONIDAE.

This family of world-wide distribution is a prominent feature of the Neozelanic Region, as besides the huge Eudoxochitons (the largest members of the family) some half a dozen smaller species of Callochitonid facies have already been described. Moreover, these show close relationship with Australian species on the one hand, and South American species on the other.

Shells varying in size from small to very large, generally of dark, more or less uniform, coloration, which, however, in some cases in life is very brilliant, but the brilliance is fugitive; sculpture a somewhat uniform coarse granulation with secondary ditches or ridges evolved on pleural areas only; girdle characters distinctive; closely packed glassy-like elongate spiculate scales laterally arranged with sometimes scattered corneous processes; insertion plates long, thick, more or less coarsely denticulate, generally brittle, many slit in end valves, usually more than one slit in median valves; sutural laminae generally continuous. Eyes present.

#### iv. Genus ICOPLAX.

1892. *Icoplax* Thiele, Das Gebiss der Schnecken (Troschel), ii., 392. Type by monotypy *Chiton puniceus* Couthouy.

Shells of medium size, sometimes small, elevated, ovate; colour more or less uniform, generally in preserved specimens dull; sculpture of end valves and lateral areas of median valves coarsely granulose as the rest of the



shell, but pleural areas bearing ditches or ridges and distinctly separated. (Note:—In our Monograph of the Australian Loricates we wrote: "Central areas longitudinally grooved," but this does not exactly apply to the type species, the ridges being elevated above the general level). The girdle is comparatively wide and covered with long slender spicules, placed latitudinally.

The internal features of the type show only one slit on each side in the median valves, whereas nearly all the rest of the species of the family are characterised by multi-slitting in this place. Moreover, while the insertion plates are generally grooved and brittle, some are scarcely pectinate and solid. Hence probably more genera will be needed, rather than less, and for the group typified by *empleura* we propose the new sub-generic name *Scrobicoplax*.

#### 14. ICOPLAX PUNICEA.

1846. *Chiton puniceus* Gould, Proc. Bost. Soc. Nat. Hist., ii., 143. Orange Harbour, South America. Type lost.  
 1847. *Chiton illuminatus* Reeve, Conch. Icon., iv., pl. xxii., sp. and fig. 147. Straits of Magellan. Type in British Museum.  
 1882. *Chiton puniceus* Gould, U.S. Expl. Exped., Moll., 324, pl. 27, fig. 412.  
 1892. *Callochiton illuminatus* Pilsbry, Man. Conch., xiv., 51, pl. 9, figs. 92-4.  
 1892. *Ischnochiton puniceus* Pilsbry, Man. Conch., xiv., 81, pl. 8, figs. 76-77.  
 1897. *Callochiton illuminatus* Suter, Proc. Mal. Soc., ii., 185, July. Off Kapiti Island, N.Z.  
 1904. *Callochiton illuminatus* Hutton, Index Faunae N.Z., 87.  
 1907. *Callochiton illuminatus* Suter, Proc. Mal. Soc., vii., 294.  
 1908. *Callochiton (Icoplax) puniceus* Thiele, Deutsche Sudpol. Exped. (Antark. Chitonen), 14 (refers to N.Z. record).  
 1909. *Callochiton puniceus* Suter, Subant. Islands, N.Z., i., 2. Snares Island, 50 fathoms.  
 1913. *Callochiton puniceus* Suter, Man. N.Z. Moll., 2. Atlas, pl. 3, fig. 8a-c.  
 1915. *Callochiton puniceus* Iredale, Trans. N.Z. Inst., xlvii., 1914, 424.

Gould described his species, using Couthouy's M.S. name as "Shell small, thin, elongated, elliptical, elevated and sharply carinated along the back, of a dull rose, or bright brick-red colour, and everywhere minutely punctured. The lateral areas are very abruptly and distinctly elevated, regularly ridged by the obtusely rounded stages of growth and bearing a few scattered granules. Central areas with the lines of increase well marked, and remarkably barred with about six elevated, longitudinal, parallel ridges, which are generally dislocated about the middle by some of the lines of increase. The posterior valve has a very minute, and acute, nearly central umbo, with an abrupt depression passing transversely through it; the margin is very minutely imbricated by prismatic scales, coloured like the shell, and with yellowish bands crossing it, opposite to the juncture of the valves.

"Length:  $12\frac{1}{2}$  mm.; breadth,  $7\frac{1}{2}$  mm.

Simultaneously Reeve introduced *C. illuminatus* thus: "Shell ovate, terminal valves and lateral areas of the rest minutely granosely rough, central areas very finely ridged, ridges slightly granulated, interstices hollow and very minutely reticulated; ligament horny, arenaceous; red throughout, ligament marked with white spots.

"Habitat: Straits of Magalhaens.

"The shell and ligament are all of an uniform red colour, the latter being marked with a white light exactly in the places occupied, in the fasciculate species, by the tufts of spiculae."



Carpenter's fuller description of Reeve's shells was printed by Pilsbry and reads: "Shell oval, red, rather elevated, the jugum acute; umbo a little in front of the middle, slightly elevated. Entire surface very minutely wrinkle-striate and granulose under a lens, the central areas longitudinally, the rest radially. Central areas with slender elevated separated threads, parallel to the jugum, 6 to 14 on each side. Lateral areas rather elevated. Interior roseate. Anterior valve with 15-16, posterior with 11-14 slits, median valves with 1 slit. Teeth acute, quite distant, scarcely propped. Eaves spongy, sinus small, the sutural plates connected across it. Girdle normal, the scales rather large, solid; sometimes spotted with paler at the sutures.

"Length: 16 mm.; breadth, 10 mm.; the divergence, 120 deg."

As a synonym Suter included *Chiton dimorphus* Rochebrune (Miss. Sci. Cap. Horn., vi., 1889, Moll., 142, pl. 9, fig. 10; Orange Harbour, Patagonia) whose description translated by Pilsbry reads: "Shell ovate-rounded, umbonate, bright-red. Anterior valve wide, concentrically lineate. Posterior valve and central and lateral areas of the intermediate valves concentrically sulcate and most minutely punctulate. The central and lateral areas have quadrangular pits at their intersections. Marginal ligament rufous, regularly striated with white lines.

"Length: 14 mm.; breadth, 10 mm."

This description does not agree and suggests another species, but all the above have been reproduced as the identity of the Neozelanic shells with the South American species is doubtful. When Suter introduced it into the fauna, he wrote: "A small specimen is in the Canterbury Museum, and was kindly submitted to me for examination by Captain Hutton. Since there is only one specimen I was not allowed to separate the valves; but, so far as examination was possible, I found it to agree perfectly with the description and figures of *Callochiton illuminatus* in Pilsbry's Man. Conch. The colour is not red, but greenish-grey; however, the same variability in colour is met with in *Chiton canaliculatus* and others. Central areas with eight separate threads on each side; end valves and lateral areas minutely granulose; median valves with one slit. Girdle scales, those characteristic of the genus, rather large. Interior greyish-white; sinus shallow.

"Length: About 10 mm.; breadth, 7 mm.; divergence, 120 deg.

"Habitat: Dredged off Kapiti Island, Cook Strait."

Later Suter added: "A young specimen, only 5 mm. long, kindly given me by Captain J. Bollons, was found amongst dredgings in 50 fathoms, near the Snares Islands. The specimen is semi-transparent, dirty-white, the characteristic girdle scales of the genus, and the sculpture of the species; there are only five elevated threads on each side of the central areas."

If it had not been for this record, which may represent a species very like *punicea*, we would have relegated all the references to the succeeding species. We have, however, thought it best to leave the two species in the list at present, rather than transfer the second species here.

#### 15. *ICOPLAX KAPITIENSIS*.

Plate x., figs. 6-7.

- 1926. *Callochiton kapitiensis* Mestayer, Trans. N.Z. Inst., lvi., 1925, 583, pl. 100, figs. 2-4, May 5. Kapiti Island, Cook Strait. Type in the Dominion Museum, Wellington, New Zealand.
- 1873. *Chiton sulcatus* Hutton, Trans. N.Z. Inst., iv., 1872, 178. Kapiti Island. Not of Quoy and Gaimard.
- 1897. *Chiton limans* Suter, Proc. Mal. Soc., ii., 197. Kapiti Islands specimens.

1904. *Chiton limans* Hutton, Index Faunae N.Z., 86.  
 1905. *Chiton limans* Hamilton, Col. Mus. Bull., No. 1, 36.  
 1913. *Chiton limans* Suter, Man. N.Z. Moll., 39 (not description and Kapiti Island specimens only).  
 1926. *Icoplax kapitiensis* Finlay, Trans. N.Z. Inst., lvii., 332.

After examination of the two specimens in the Dominion Museum from Kapiti Island, Cook Strait, which had been determined as *Chiton sulcatus* by Hutton and recorded by Suter as *Chiton limans*, Miss Mestayer described them as a new species of *Callochiton* under the name *kapitiensis*. It seems an obvious conclusion that the specimen recorded by Suter as *Callochiton illuminatus* from the same locality is referable to this species. It must be remembered that Suter's description of *Chiton limans* given in the Manual was based upon the Australian species and not upon the Kapiti Island specimens.

Miss Mestayer's description is here given: "Shell small, narrow-oval, side slopes very slightly convex, jugum acute, mucro median. Colour: Shell whitish-brown, mantle reddish-brown. Sculpture: The head valve, lateral areas, jugal area, and posterior two-thirds of tail valve closely covered with very minute granules, clearly defined only under a strong hand lens. Two concentric growth lines clearly marked on all valves. Posterior margins of valves 1-7 finely denticulate. Under lens two other growth lines can be seen on head valve. Median valves: Lateral areas strongly marked, pleural areas with eight very narrow raised longitudinal ridges, interstices about three or four times width of ridges. Posterior margins straight. Valves 6 and 7 of holotype, badly broken on right side. Tail valve: Pleural areas ridged, mucro small, nearly central, posterior portion slightly concave. Girdle narrow, densely covered with small pillar-like scales in mottlings of reddish-brown and white.

"Length: 9 mm.; breadth, 5 mm.

"Locality: Kapiti Island, Cook Strait.

"Remarks: The disarticulate remains of a paratype show that the insertion plates are narrow, head valve with 15 or 16 very shallow slits, median valves 1 slit, and the interior bluish-white. A living specimen. Colour: Shell light brown, the lower two-thirds of lateral areas of valves 3-5 dark brown; tail valve dark brown with a white stripe from mucro to margin. Girdle same colour as shell, faintly mottled with dark brown, with fine hair-like spicules scattered about it, and a very delicate fringe at the edge."

#### 16. ICOPLAX EMPLEURA.

Plate x., figs. 1-5.

1872. *Chiton empleurus* Hutton, Trans. N.Z. Inst., iv., 1871, 178. Habitat ? Type in the Dominion Museum, Wellington, New Zealand.  
 1873. *Chiton empleurus* Hutton, Cat. Marine Moll. N.Z., 48.  
 1880. *Chiton empleurus* Hutton, Man. N.Z. Moll., 113.  
 1897. *Callochiton empleurus* Suter, Proc. Mal. Soc., ii., 185, July.  
 1904. *Callochiton empleurus* Hutton, Index Faunae N.Z., 87.  
 1905. *Callochiton empleurus* Hamilton, Col. Mus. Bull., i., 36.  
 1905. *Callochiton empleurus* Suter, Journ. Malac., xii., 65, pl. ix., figs. 1-4. (December 30). Stewart Island specimen.  
 1913. *Callochiton empleurus* Suter, Man. N.Z. Moll., 13. Atlas, pl. 3, fig. 7a-d.  
 1915. *Callochiton empleurus* Iredale, Trans. N.Z. Inst., xlvii., 1914, 424.  
 1921. *Callochiton empleurus* Mestayer, Trans. N.Z. Inst., liii., 180.  
 1924. *Callochiton empleurus* Odhner, Vidensk. Medd. Dansk. Nat. Foren. Bd., 77 (N.Z. Moll.), 6 (Campbell Island).

1926. *Callochiton empleurus* Mestayer, Trans. N.Z. Inst., lvi., 583.  
 1926. *Icoplax empleurus* Finlay, Trans. N.Z. Inst., lvii., 332 (littoral). Dunedin, New Zealand.

Hutton did not know whence the specimens came when he introduced the species thus: "Oblong; margin with very minute scales; valves rather elevated and flattened on each side, subcarinate; posterior margins slightly concave, with a small central point; terminal and lateral areas raised above the rest minutely punctate; median areas minutely punctate, sometimes with a row of deep longitudinal pits along the anterior edges of the raised lateral areas.

"Length: .75 inch; breadth, .3 inch.

"Colour: Uniform yellowish-pink.

"Founded on two specimens in the Colonial Museum; locality not stated."

Pilsbry (Man. Conch., xv., 1893, 67) ranked the species as a synonym of *Callochiton crocinus* Reeve, "fide Hutton in litt."

This conclusion was negatived by Suter, who explained: "On the glass tablet labelled '*Chiton empleurus*,' there were not only two specimens, but also two species. One of them is Hutton's *C. empleurus*, but the larger specimen I found to correspond exactly with specimens of *C. platessa*, from Port Jackson. . . . The elongated form and the deep longitudinal pits along the anterior edge of the lateral areas distinguish this species at once from *C. platessa*, with which it has been supposed to be identical. In Hutton's diagnosis the word 'sometimes,' that precedes 'with a row of deep pits, etc,' must be struck out. There are 9-10 pits on each side. *C. empleurus* seems somewhat to approach *Ischnochiton* (or *Callochiton* ?) *puniceus*, Couth., which latter, however, I have not seen. I have nothing to add to Hutton's description, because the type specimen could not be taken to pieces, and the classification of the species rests only on the character of the girdle scales, which are very similar to those of *C. platessa*."

Later receiving specimens, Suter more fully described them: "Shell small, elongated oval, subcarinated, slopes very slightly convex, flesh-colour, with a squarish white patch on the posterior part of the jugal tract. Anterior valve almost smooth, but minutely punctate; anterior margin with square white spots at irregular distances, and faint traces of radiate riblets. Posterior margin with a median notch. Intermediate valves. Central area minutely punctate, the jugum mostly smooth, with a few transverse shallow furrows; the pleural tracts with 9-10 deep pits on each side in front of the anterior edge of the lateral areas; these short pits become shorter and shallower towards the median part of the valve. Lateral areas raised, distinct, with well pronounced concentric ridges. Posterior valve rather indistinctly minutely punctate, with a subcentral mucro, posterior slope slightly concave. Girdle with characteristic minute, elongated, and imbricating glossy scales. Colour of valves fleshy, lighter and with white streaks on the jugum. A white squarish spot on each intermediate valve on the posterior part of the jugum, and on the tail valve in front of the mucro. Interior pink, with the sutural laminae white. Sinus rather broad, shallow. Intermediate valves with 3 slits on each side.

"Length: 22 mm.; breadth, 9 mm.; divergence, 83 deg.

Habitat: Near Stewart Island in about 15 fathoms."

Odhner added: "Campbell Island, Perseverance Harbour, 20 fathoms, 6 specimens, length (of largest) 9. They are probably not full-grown, since there are 6-7 pits on the sides of the lateral areas. Suter has not stated the number of slits in the terminal valve, because of the scarceness of his

material. They amount to 14. In the anterior valve there were about 23 irregularly disposed ones."

Through the courtesy of the Director of the Dominion Museum, Wellington, New Zealand, to whom our sincere thanks are here tendered, we have been enabled to study the type of *Chiton empleurus* Hutton, a figure is given from the specimen and a new description is here offered: Shell narrowly elongate, oval, elevated, keeled, side slopes nearly straight, girdle, somewhat curled in, scaly. Colour pinkish, indistinctly mottled with brownish, more noticeable towards the apices, which are a little eroded. Sculpture consists of very fine punctulation throughout, lateral areas large, strongly elevated, growth lines obsolete; pleural areas with a series of ditches along the edge of the lateral areas, nine to twelve in number on each side, longest at the extreme edge, but still short and only extending across, getting shorter inwards and dying out before they reach the jugum. Mucro about the anterior third, elevated, post-mucronal slope very slightly concave. Median insertion plates at least three slit, those of end valves not examined. Girdle wide, surface of scales very small, placed latitudinally and showing narrow oval tips only. Length (a little curled) 17 mm.; breadth (girdle curled in) 7.5 mm. Three valves from another specimen (figured) show the insertion plates of terminal valves to be short, thick, not brittle, slightly grooved, fifteen slits, very irregular, in anterior valve, eleven also very irregular, in posterior valve, four in median valve; sutural laminae continuous.

#### 17. *ICOPLAX SULCULATA*.

Plate x., figs. 8-11.

1907. *Callochiton sulcatus* Suter, Proc. Mal. Soc., vii., 294, fig. 5 in text (June 25). Dusky Sound, New Zealand. Type in Coll. Suter, now in Wanganui Museum, New Zealand.  
 1913. *Callochiton sulcatus* Suter, Man. N.Z. Moll., 14. Atlas: pl. 3, fig. 9.  
 1915. *Callochiton sulcatus* Iredale, Trans. N.Z. Inst., xlvii., 1914, 424.  
 1924. *Callochiton sulcatus* Odhner, Vidensk. Medd. Dansk. Nat. Foren. Bd., 77 (N.Z. Moll.), 7. North Island.  
 1926. *Icoplax sulcatus* Finlay, Trans. N.Z. Inst., lvii., 332.

Suter's description is all we know about this species: "Shell very small, angularly raised, side slopes straight, central areas laterally grooved, colour light fulvous. Anterior valve smooth, with a few fine growth lines, the whole surface dotted with small black eyes. Intermediate valves having the jugum sharply rounded, central areas microscopically longitudinally closely striate, on each side 4 to 5 deep grooves, twice as broad as the ribs. the innermost groove extending only over half the length; lateral areas distinctly raised, microscopically radially striate, with numerous eyes, flatly and broadly nodulous by a few concentric furrows, more pronounced near the margins; sutures crenate. Posterior valve smooth, with many eye-dots; mucro in front of the middle, low; posterior slope slightly concave. Girdle with elongated, pointed, and slightly keeled smooth scales. Colour light fulvous, darker on the end valves and lateral areas; girdle white, with fulvous patches. Interior pinkish-white; anterior valve with 14, median valves with 2, and posterior valve with 10 slits; teeth blunt, propped up on the outside; eaves spongy; the low and broadly rounded sutural laminae continuous across the shallow sinus. The approximate dimensions are:—Length, 9 mm.; width, 6 mm.; divergence, 105 deg.

"Habitat: One specimen amongst material dredged by Mr. R. Henry in 30 fathoms, Dusky Sound.



"With regard to sculpture of the lateral areas this species stands between *C. empleurus* and *C. illuminatus*; the former, however, has 4, the latter only 1 slit on the intermediate valves."

Odhner has added: "North Island, North Channel, Kawau Island, 10 fathoms, 1 specimen, length, 10 mm. Colour coralline red, lateral areas white clouded; 6th and 7th valve of a whitish colour (except the red apices) which occupies also the adjacent part of the girdle. In its sculpture the present specimen shows the peculiarity of having the sulci of the lateral areas most distinct on plate 6 and 7, 2 and 1."

V. Genus PARICOPLAX nov.

Shell small to medium for the family, more or less depressed, oval, roundbacked, rarely carinated, girdle scaly.

Colour, when dead, dullish, but when alive, bright, apparently agreeing with its environment, reddish, dark and light, often varied with shades of green and yellowish, but these bright shades vanish with death.

Sculpture entirely minutely granulose forming a matt surface; lateral areas scarcely raised and not specially distinguished.

Girdle scales characteristic; elongate slender, glassy spicules packed latitudinally so that the ends only show superficially.

This genus is founded on the well known shell hitherto known as *platessa*, but here determined as *crocinus* Reeve.

We introduced in the Monograph of the Australian Loricates the genus name *Levicoplax*, definitely designating as type *Chiton platessa* Gould. That species turns out to have been wrongly determined, and is the common New South Wales *Ischnochiton*, so that the genus name *Levicoplax* falls into the synonymy of *Ischnochiton*, and it is necessary to introduce a new name for this group.

18. PARICOPLAX CROCINA.

Plate x., figs. 12-13.

1847. *Chiton crocinus* Reeve, Conch. Icon., iv., pl. xxii., sp. and fig. 146.  
Habitat unknown = New South Wales. Type in British Museum.
1852. *Chiton versicolor* A. Adams, Proc. Zool. Soc., 1852, 92, pl. xvi., fig. 5.  
Sydney, New South Wales. Type in British Museum.  
Not *Chiton versicolor* Sowerby, Mag. Nat. Hist., 1840.
1877. *Chiton platessa* Tenison Woods, Proc. Linn. Soc. N.S.W., ii., 252.  
Gould's description reprinted.
1886. *Callochiton platessa* Haddon, Chall. Rep. Zool., xv. (pl. xliii.), 15.  
N.Z. in British Museum.
1892. *Callochiton platessa* Pilsbry, Man. Conch., xiv., 49, pl. 10, figs. 1-5.
1893. *Callochiton crocinus* Pilsbry, Man. Conch., xv., 67, for xiv., pl. 10, fig. 7.
1897. *Callochiton platessa* Suter, Proc. Mal. Soc., ii., 184.
1904. *Callochiton platessa* Hutton, Index Faunae N.Z., 87.
1905. *Callochiton platessa* Hamilton, Col. Mus. Bull., i., 36.
1908. *Callochiton platessa* Iredale, Trans. N.Z. Inst., xl., 1907, 374.
1910. *Callochiton platessa* Iredale, Proc. Mal. Soc., ix., 157.
1913. *Callochiton platessa* Suter, Man. N.Z. Moll., 13, Atlas, pl. 3, fig. 7a-d.
1915. *Callochiton platessa* Iredale, Trans. N.Z. Inst., xlvii., 1914, 424.
1922. *Callochiton platessa* var. *fossa* Ashby, Trans. Roy. Soc. S.A., xlvii., 19, pl. iii., fig. 4. Port Jackson, New South Wales. Type in Coll. Ashby.
1923. *Callochiton platessa* May, Illus. Index Tas. Shells, pl. xiv., fig. 7.
1924. *Callochiton platessa* Finlay, Trans. N.Z. Inst., lv., 517.

1925. *Levicoplax platessa* Iredale and Hull, Aust. Zool., iii., 349, pl. xxxix., fig. 30.
1846. *Not Chiton platessa* Gould, Proc. Bost. Soc. Nat. Hist., ii., 143. New South Wales = Port Jackson. Type lost (?).
1852. *Not Chiton platessa* Gould, U.S. Expl. Exped., 320, atlas, figs. 434-434a.
1862. *Not Lepidopleura platessa* Gould, Otia Conch., 242.

This species has been known by the name of *platessa* Gould, through some blunder in the early history of the species, and this misidentification has persisted through many years until we began introducing the original descriptions in this essay. When we read the original Latin diagnosis, doubt was immediately raised, and, as Gould gave an English translation himself there is no doubt, especially since figures were given to illustrate the species.

These diagnoses are here given as the books including them are rare and difficult of access. The original Latin definition reads: Testa parva, tenuis, elongato-ovalis, transversim arcuata, citrino-olivacea, ubique minutissime punctata; areis lateralibus parvis, vix elevatis, lineis 2-3 inconspicuis striatis; areis centralibus lineis confertis acutis granulatis arcuatim decussatis; valvâ posticâ magnâ, obscurè radiatâ; margine virente, fusco tessellato, minutissime granulato; intus caeruleo-virescens. Long., 7/8; lat., 9/20 poll.

Habitat: New South Wales.

The English account is here added: "Shell rather small and thin, oval, much elongated, transversely arched, of a yellowish olive colour, minutely punctured in quincunx at every part. The valves are flattened, without beaks or keel, the tips denuded; lateral areas very small, striated with two or three radiating lines; central areas with very fine, sharp, granulated, longitudinally arcuated lines, like jeweller's engine work, posterior valve large, faintly radiated. Margin covered with granules so minute as scarcely to be distinguished by the naked eye, chequered green and dusky. Inside bluish-green.

"Length: Seven-eighths of an inch; breadth, nine-twentieths of an inch.

"Habitat: New South Wales.

"Similar in its general aspect to *C. fruticosus*, but smaller, smoother, and the sculpture of the lateral areas and terminal valves entirely different. It is almost exactly like fig. 67 of the "Conchological Illustrations," which is said to be a variety of *C. longicymba*. In form it resembles *C. catenulatus* Sowb."

The shape, tenuity and colour attract attention as being unlike the conventional "*platessa*," but the item "lateral areas striated" definitely precludes the association of the well known shell with the name, while the illustrations show this striated sculpture, as well as the central area sculpture, and also the girdle scales.

The error apparently originated in Carpenter's acceptance, without reference to the type, of some Australian shells as "*platessa*," and then this was reinforced by the description of characters peculiar to the present genus, and hence the error became established.

Simultaneously Reeve had described a species, *C. crocinus*, thus: "Shell ovate, terminal valves and lateral areas of the rest concentrically sculptured with waved wrinkles, the surface being most minutely punctured, central areas undulately decussated with minute ridges; saffron yellow, stained in the middle with light purple; ligament horny, tessellated.

"Habitat (?): A species most peculiar in colour, and not less in sculp-

ture; the surface of the central areas having the appearance of coarse cloth or canvas."

A few years later A. Adams correctly described the species from Sydney, New South Wales, but unfortunately selected a preoccupied name, so that it is unnecessary to transcribe his Latin description.

Haddon published the synonymy of *platessa*, *crocinus* and *versicolor*, ascribing it to Carpenter, apparently only on M.S. notes in the British Museum, written on the back of the tablets by Carpenter. Pilsbry published Carpenter's M.S. notes which never referred to the type of "*platessa*," and since then no doubt has been expressed, though it is obvious an error has been made. The Neozelanic form was for many years very rare, but recently intensive search has shown it to be much less uncommon than supposed. Criticism of such specimens with Australian ones show very little distinction, and, as we have pointed out, the latter is very variable in elevation and breadth, we cannot at present separate the Neozelanic shells. Ashby introduced a varietal name "*fossa*" for Australian shells, which have developed a few irregular sulci on valves vi.-viii., and this phase has not yet been seen from New Zealand.

#### 19. PARICOPLAX MORTENSENI.

Plate x., figs. 14-15.

1924. *Callochiton mortenseni* Odhner, Vidensk. Medd. Dansk. Nat. Foren. Bd., 77 (N.Z. Moll.), 6, figs. in text. Campbell Island. Type in Stockholm Museum, Sweden.

1926. *Levicoplax mortenseni* Finlay, Trans. N.Z. Inst., lvii., 332.

Odhner's description (which is all we know of this species): "Shell ovate, dark brown, shining, smooth, bluntly keeled, dorsally, slightly convex at the lateral slopes. Anterior valve a little broader than the posterior one, with a few concentric growth lines (in the one specimen with 4 concentric regularly distant sulci), otherwise smooth and showing only microscopic radiating striae and impressed dots which are densest towards the margin. Intermediate valves beaked, with elevated lateral areas, totally smooth, except for lines of growth (and occasional impressed dots towards the margins, and furrows; 4 concentric ones in one specimen), microscopically striated longitudinally. Posterior valve with a premedian mucro; its central area separated, by means of straight lines, from the posterior elevated area, which has a straight or slightly concave slope. All valves porous, the pores appearing as microscopical regular dots all over the surface. Eyes in a small number, occupying a median ray on the lateral areas, most obvious in their upper parts. Girdle narrow, rusty brown, lighter at the margin, with close elongate scales and fringed with short acicular ones. Interior of the valves crimson; anterior valve with 16 slits; posterior one with 12, median valves with 4 or 5; teeth solid, propped outside, eaves porous, sutural plates united, sinus shallow, broad. Gill cordon extending from the anterior corners of the foot to near the foot end.

"Locality: Campbell Island, 45 (= Perseverance Harbour, 20 fathoms); 2 specimens; maximum length, 13 mm.; breadth, 8.5 mm.

Compared with *C. steinenti* from South Georgia, which has a similar colour, the present species shows much smaller and denser girdle scales, as well as completely smooth, not granulose, and distinctly microscopically striated valves; in the latter respect it differs also from *C. platessa*, in which a tendency to granulation of the lateral and central areas appears. The number of slits of the intermediate valves (in *C. steinenti* 2, in *C. platessa* 3) is another point of distinction."

20. *PARICOPLAX PERSCRUTANDA* sp. nov.

Plate x., figs. 25-26.

Shell very small, depressed, broadly oval, girdle wide.

Colour brownish green, variegated with paler green.

Sculpture obsoletely quincuncially papillate throughout; lateral areas a little raised, but not otherwise differentiated; valves three times as broad as deep, mucro very anterior.

Girdle scales typical, but larger than those of *crocina*.

Dimensions: 6 x 4.5 mm. (type in Australian Museum).

Station: On shell of *Haliotis iris* taken at extreme low tide at Taylor's Mistake, near Lyttelton, Canterbury, New Zealand.

Habitat: New Zealand.

Note.—This little species is described to attract attention to the probability of other small Loricates existing on the same station.

vi. Genus *QUAESTIPLAX* nov.21. Type *Quaestiplax wilsoni* nov.

Plate ix., fig. 2.

This genus is introduced for a minute shell from Lord Howe Island, which superficially recalled *Terenochiton*, but upon dissection proved to show many features peculiar to *Icoplax*, and it appears to be a degenerate ally of that series.

Shell very small, elongate oval, uniformly dull-coloured, pale creamy buff, of median elevation; girdle wide, scaly.

Sculpture of pustules, arranged in quincunx, massing and obsoletely showing ray formation on lateral areas and end valves, less defined on jugal area, lateral areas small, well elevated.

Post-mucronal area of posterior valve, similarly small and a little concave; ante-mucronal area large, nearly twice the depth of the post-mucronal area, mucro at about the posterior third elevated.

Interior white. Insertion plates present, stout and short, one or more slit in median valves, many slit in end valves, fourteen in anterior valve, fifteen in posterior valve; the slitting is very irregular, faint grooving discernible on anterior plate, while posterior plate is shortened and tending to elimination; sutural laminae small, very widely separated.

Girdle scales very small, irregularly elongately oval, non-striate, a fine spiculate edge present; the girdle scales are obliquely placed, tending to lateral formation.

Dimensions: 4 x 2 mm. (type).

Station: Under stones associated with *Terenochiton catenatus* Hedley and Hull.

Habitat: Lord Howe Island.

This interesting little Loricata was collected by Hull in 1907, and later many examples were sorted out of washings made by Mr. Roy Bell from the underside of dirty stones. It is associated with Mr. Herbert Wilson, who collected with Hull in 1907, and for him later. Type in Australian Museum.

The above description covers both specific and generic features, the most notable in connection with the latter being the association of widely separated sutural laminae, rather characteristic of *Terenochiton*, etc., and the multi-slit insertion plates, the disappearing tendency of the latter in the posterior valve first, and the girdle scales, very like, but not so latitudinally placed as those of *Paricoplax*.



vii. Genus EUDOXOCHITON.

1853. *Eudoxochiton* Shuttleworth, Mittheil. naturf. Gesellsch. Berne, 191.

Type by monotypy *Acanthopleura nobilis* Gray.

Shells very large for the family, oval, elevated or depressed, girdle wide, leathery, beset with short scattered spinelets.

Coloration dark brown (generally uniform).

Sculpture uniformly minutely granulose. Eyes present. Interior with multislit median valve insertion plates, many slit end valves, sutural laminae continuous.

The species occur throughout New Zealand and to the Kermadec Islands, but are at present unknown from the Subantarctic Islands, while a closely allied genus, *Eudoxoplax*, is restricted to Tasmania.

The radula proves that the group belongs to the family *Lepidochitonidae*, as was easily recognised by the superficialities and the internal characters, a very young *Eudoxochiton* recalling the commoner smaller shells.

Bucknill's account (T.N.Z.I., 59, 1928, 625) of the eyes and minute sculpture should be referred to.

22. EUDOXOCHITON NOBILIS.

Plate x., figs. 22-23.

1843. *Acanthopleura nobilis* Gray, Travels in New Zealand (Dieffenbach), ii., 245. New Zealand. Type in British Museum.
1847. *Chiton nobilis* Reeve, Conch. Icon., iv., pl. 21, fig. 139 (ex Gray M.S. in British Museum = Gray's type as above).
1853. *Chiton* (*Eudoxochiton*) *nobilis* Shuttleworth, Mittheil. naturf. Gesellsch. Berne, 191.
1872. *Chiton nobilis* Hutton, Trans. N.Z. Inst., iv., 1871, 181.
1873. *Chiton nobilis* Hutton, Cat. Marine Moll. N.Z., 49.
1874. *Chiton* (*Chaetopleura*) *nobilis* Smith, Voy. Erebus & Terror, Moll., 4, pl. 1, fig. 8 (type figured).
1880. *Chaetopleura nobilis* Hutton, Man. N.Z. Moll., 115.
1892. *Chaetopleura nobilis* Pilsbry, Man. Conch., xiv., 30 (Reeve's description and figure only).
1893. *Eudoxochiton nobilis* Pilsbry, Man. Conch., xiv., 193, pl. 46, figs. 88-95.
1897. *Eudoxochiton nobilis* Suter, Proc. Mal. Soc., ii., 197.
1904. *Eudoxochiton nobilis* Hutton, Index Faunae N.Z., 86.
1905. *Eudoxochiton nobilis* Hamilton, Col. Mus. Bull., i., 36.
1905. *Eudoxochiton nobilis* Nierstrasz, Notes Leyden Mus., xxv., 151.
1913. *Eudoxochiton nobilis* Suter, Man. N.Z. Moll., 41. Atlas: pl. 2, figs. 20-25; pl. 4, fig. 14.
1914. *Eudoxochiton nobilis* Iredale, Proc. Mal. Soc., xi., 126.
1915. *Eudoxochiton nobilis* Iredale, Trans. N.Z. Inst., xlvii., 1914, 424.
1924. *Eudoxochiton nobilis* Odhner, Vidensk. Medd. Dansk. Nat. Foren. Bd., 77. (N.Z. Moll.), 9. North Island and Stewart Island.
1928. *Eudoxochiton nobilis* Bucknill, Trans. N.Z. Inst., lix., 625-6, fig. in text (ocelli).

The original description is brief, but recognisable: "Mantle rugose, rough, with scattered long tapering brown bristles; valves brown, convex, evenly rounded, with very minute dots like shagreen, the lateral area slightly marked with 3 or 4 indistinct rays; inside white; length, 3 inches."

Reeve figured the specimen and then E. A. Smith gave another figure, some thirty years later.

The species may be described more fully as follows: Shell large, elongate oval, elevated, side slopes curved, girdle leathery, with scattered spine-

lets. Colour, red brown. Sculpture: The whole of shell is minutely punctulate, rarely tending to radiation, lateral areas little differentiated and elevated; mucro of the posterior valve antemedian, the post-mucronal slope not steep, the posterior edge slightly sinuate. Interior pure white, sutural laminae large, continuous, a shallow sinus medially; insertion plates short, stout, deeply grooved so that teeth are not easily counted. Teeth very irregular, 25-30 in anterior valve, 3-6 in median valves, 24-25 in posterior valve. Angle of divergence of valves, 100 deg. to 110 deg.

Dimensions: Length, 65 mm.; breadth, 41 mm.; up to 110 mm. in length.

Station: On rocks below median tide facing heavy sea.

Habitat: New Zealand.

### 23. EUDOXOCHITON HUTTONI.

Plate x., fig. 24.

1893. *Eudoxochiton huttoni* Pilsbry, Man. Conch., Ser. i., xiv., 194, pl. 46, figs. 96-100. New Zealand. Type in Acad. Nat. Sci. Philad. Coll.  
 1897. *Eudoxochiton huttoni* Suter, Proc. Mal. Soc., ii., 198.  
 1904. *Eudoxochiton huttoni* Hutton, Index Faunae N.Z., 86.  
 1905. *Eudoxochiton huttoni* Hamilton, Col. Mus. Bull., i., 36.  
 1913. *Eudoxochiton huttoni* Suter, Man. N.Z. Moll., 41. Atlas: pl. 4, fig. 15.  
 1915. *Eudoxochiton huttoni* Iredale, Trans. N.Z. Inst., xlvii., 1914, 424.  
 1928. *Eudoxochiton huttoni* Bucknill, Trans. N.Z. Inst., lix., 626, fig. —.

This species was introduced by Pilsbry, as follows: "Shell oval, depressed, with convex side slopes. Colour dark brown, the girdle greenish brown. Valves broadly V-shaped, not beaked, rounded at the ends; the lateral areas well raised. Entire surface smooth, except for a microscopic punctulation and slight growth lines. Posterior valve depressed, the mucro plane, central; posterior margin hardly marginate. Interior white, smooth. Sutural plates continuous across the sinus, which is indicated by a shallow wave or bay. Insertion plates blunt, deeply pectinated, the anterior valve having 17, central 3, posterior 19 short slits. Eaves very narrow and grooved along the teeth. Girdle leathery, bearing numerous short, rigid, dark brown spinelets.

"Length: 50 mm.; breadth, 34 mm.; divergence, 135 deg. to 140 deg.

"This species is closely allied to *E. nobilis*, from which it differs in the proportions of the valves, depressed form, fewer slits, etc."

This appears to be one of the rarest of Neozelanic Loricates, as all we have recently seen under this name have been depressed, immature specimens of the preceding species. It is apparently a deeper water form and may represent an ecological variation; the slitting in the type may be abnormal, but it is well to leave the name in view, and also those of the two succeeding forms. The latter were found under recognisable ecologic conditions, and were thus separated, and if they be lumped, then the present species must also be suppressed. We have found lumping ever to prove a dangerous policy, so here allow the whole four in order that inquiry may be stimulated. Superficially they resemble each other so much that we have only reproduced the two Kermadec pictures with sketches of the elevation of the valves; these, however, are somewhat misleading, and it is necessary to study specimens, the long account given some years ago by Iredale being here reproduced.

24. *EUDOXOCHITON PERPLEXUS*.

Plate x., figs. 16-18.

1914. *Eudoxochiton perplexus* Iredale, Proc. Mal. Soc., xi, 29, pl. i., figs. 4, 6, 8. Sunday Island, Kermadec Group. Type in Canterbury Museum, Christchurch, New Zealand.  
1915. *Eudoxochiton perplexus* Oliver, Trans. N.Z. Inst., xlvii., 1914, 557. var. *typica*, id., ib.

"Shell large, oval, elevated; valves arched, side slopes almost straight; girdle leathery, with short spinelets. Colour uniform reddish-brown, girdle greenish-brown. The only sculpture is minute punctulation, though indistinct radiation may sometimes be observed on the anterior valve, whilst growth lines are commonly seen on the central areas. Anterior valve comparatively small. Median valves narrow, lateral areas well raised. Posterior valve with the mucro elevated at about the anterior third, the posterior slope slightly concave. Inside coloration pure white. Anterior valve has the insertion plate very short, and cut into about twenty-three teeth, which are irregularly deeply pectinated. Median valves with sutural plates continuous, the sinus only indicated by a shallow depression. Insertion plates short, with three or four teeth as in anterior valve. Posterior valve faintly emarginate on the posterior border, the insertion plate very short and not projecting beyond the tegmentum. About twenty-three slits can be counted, the teeth as in anterior valve. Girdle leathery, covered with short brown spinelets. Length of type, 59 mm.; breadth, 40 mm.

"Habitat: Sunday Island, Kermadec Group.

"Station: On rocks about low tide."

25. *EUDOXOCHITON IMITATOR*.

Plate x., figs. 19-21.

1914. *Eudoxochiton imitator*, Iredale, Proc. Mal. Soc., xi, 30, pl. 1, figs. 5, 7, 9. Sunday Island, Kermadec Group. Type in Canterbury Museum, Christchurch, New Zealand.  
1915. *Eudoxochiton perplexus* var. *imitator* Oliver, Trans. N.Z. Inst., xlvii., 1914, 557.

"Shell large, oval, depressed; valves slightly keeled, side slopes straight, girdle leathery with short spinelets. General coloration uniform dark-brown, girdle pale greenish-brown. Sculpture as in preceding species. Contrasted with the foregoing species the valves are more depressed, posterior valve with mucro planate, almost central. Inside coloration pure white. Sutural laminae longer than in the above species, and the sinus even less pronounced. Insertion plates longer, and the anterior valve with more than twenty-five teeth, the posterior about twenty-two. Girdle leathery, with short brown spinelets. Length of type: 59 mm.; breadth, 40 mm.

"Habitat: Sunday Island, Kermadec Group.

"Station: On rocks below low tide.

" . . . The *Eudoxochitons* of Sunday Island are very puzzling, as the existence of two forms on such a small island I could scarcely credit myself. Yet the shells seem easily separable into two lots, which might be classed as varieties of *nobilis* Gray; they differ in general forms as much from each other as from that species, and are both less elevated. One form is even lower than *huttoni* Pils., though in the characters and number of the teeth it absolutely agrees with the other. . . .

"Remarks: I have here admitted the two forms above indicated as distinct species, and would fully note the differences observed. *E. perplexus* was first collected, and it was noted as being less elevated than *E. nobilis* Gray, though quite unlike *E. huttoni* Pils. Collectors of *Eudoxochiton* well know the rarity of the genus, and very few specimens were obtained. Valves were not uncommonly met with on the beach, and examination of these constantly gave the number of slits in the anterior and posterior valves as about twenty-two or twenty-three. . . .

"In the winter the sand moved along the north coast and forced a large number of *Eudoxochiton* to come up to low water mark. This unexpected opportunity was greedily seized to collect every specimen, and it was then found that the majority of these differed in their depressed form and darker coloration, which was noticeable at sight. Moreover, they were beautifully clean specimens, such as had never been collected before. In New Zealand, even the smallest specimens of these Chitons are covered with ugly extraneous growths, and the earlier collected Kermadec specimens were dirty and worn. I have now concluded that this depressed form must be a deeper water dweller. It is easily separated from *E. perplexus* by its depressed form, different posterior valve, and longer teeth, whilst the coloration is also darker. It cannot be confused with either *E. nobilis* Gray or *E. huttoni* Pilsbry, and, on account of its pseudo-resemblance to the latter, I have called it *E. imitator*.

"There would seem to be grounds for supposing the depressed form to be the oldest, as juveniles of all four species are very flattened and scarcely determinable. The girdle is simply leathery with a crinkled appearance, with only signs of the short spinelets thereon. I have juveniles of the Kermadec species which I would not definitely distinguish, since I do not think they could be easily differentiated from juveniles of *E. nobilis* Gray, which I collected in the South Island of New Zealand. It is certain that the Kermadec species are smaller than the New Zealand ones, the valves being comparatively broader and the girdle comparatively narrower. The largest Kermadec specimen is under 70 mm. long and 45 mm. broad, whilst an average sized Neozelanic *E. nobilis* Gray, measures 75 mm. long by 50 mm. broad, and specimens 110 mm. in length are known to exist. These measurements are taken from specimens with the girdle well preserved and flattened."

#### EXPLANATION OF PLATE IX.

- Fig. 1. *Ischnochiton circumvallatus* Reeve, whole shell.  
 2. *Quaestiplax wilsoni* Iredale & Hull, whole shell.  
 3. *Terenochiton inquinatus* Reeve, whole shell.  
 4. *Terenochiton inquinatus* Reeve, exterior of median valve, copied from Odhner, Stewart Island.  
 5. *Terenochiton inquinatus* Reeve, exterior of median valve, copied from Odhner, Campbell Island.  
 6. *Terenochiton inquinatus* Reeve, exterior of median valve, copied from Odhner, Auckland.  
 7. *Terenochiton norfolcensis* Hedley & Hull, whole shell.  
 8. *Terenochiton norfolcensis* Hedley & Hull, exterior of anterior valve.  
 9. *Terenochiton norfolcensis* Hedley & Hull, exterior of median valve.  
 10. *Terenochiton norfolcensis* Hedley & Hull, exterior of posterior valve.  
 11. *Terenochiton subtropicalis* Iredale, whole shell.  
 12. *Terenochiton subtropicalis* Iredale, side view of whole shell.



13. *Terenochiton otagoensis* Iredale & Hull, whole shell.
14. *Terenochiton catenatus* Hedley & Hull, whole shell.
15. *Terenochiton catenatus* Hedley & Hull, exterior of anterior valve.
16. *Terenochiton catenatus* Hedley & Hull, exterior of median valve.
17. *Terenochiton catenatus* Hedley & Hull, exterior of posterior valve.
18. *Terenochiton fairchildi* Iredale & Hull, whole shell.
19. *Terenochiton fairchildi* Iredale & Hull, exterior of anterior valve.
20. *Parachiton mestayerae* Iredale, whole shell.

# EXPLANATION OF PLATE X.

- Fig. 1. *Icoplax empleura* Hutton, whole shell.
2. *Icoplax empleura* Hutton, exterior of anterior valve.
  3. *Icoplax empleura* Hutton, exterior of median valve.
  4. *Icoplax empleura* Hutton, exterior of posterior valve.
  5. *Icoplax empleura* Hutton, interior of posterior valve.
  6. *Icoplax kapitiensis* Mestayer, whole shell, copied from Mestayer.
  7. *Icoplax kapitiensis* Mestayer, side view of whole shell, copied from Mestayer.
  8. *Icoplax sulculata* Suter, anterior valve, copied from Suter.
  9. *Icoplax sulculata* Suter, posterior valve, copied from Suter.
  10. *Icoplax sulculata* Suter, girdle scales, copied from Suter.
  11. *Icoplax sulculata* Suter, median valve, copied from Suter.
  12. *Paricoplax crocina* Reeve, whole shell.
  13. *Paricoplax crocina* Reeve, exterior of median valve.
  14. *Paricoplax mortenseni* Odhner, whole shell, copied from Odhner.
  15. *Paricoplax mortenseni* Odhner, exterior of median valve, copied from Odhner.
  16. *Eudoxochiton perplexus* Iredale, whole shell.
  17. *Eudoxochiton perplexus* Iredale, side view of whole shell.
  18. *Eudoxochiton perplexus* Iredale, median valve to show elevation.
  19. *Eudoxochiton imitator* Iredale, whole shell.
  20. *Eudoxochiton imitator* Iredale, side view of whole shell.
  21. *Eudoxochiton imitator* Iredale, median valve to show elevation.
  22. *Eudoxochiton nobilis* Gray, median valve to show elevation.
  23. *Eudoxochiton nobilis* Gray, girdle covering.
  24. *Eudoxochiton huttoni* Pilsbry, median valve to show elevation, copied from Pilsbry.
  25. *Paricoplax perscrutanda* Iredale & Hull, whole shell.
  26. *Paricoplax perscrutanda* Iredale & Hull, girdle scales.
  27. *Icoplax kapitiensis* Mestayer, girdle scales, copied from Mestayer.

NEW FORMS OF MOSAIC-TAILED RATS (*MELOMYS* AND *UROMYS*)  
FROM HINCHINBROOK ISLAND, QUEENSLAND.

By E. LE G. TROUGHTON and A. S. LE SOUEF, C.M.Z.S.

(By Permission of the Trustees of the Australian Museum.)

Well known to travellers on the Queensland coast, Hinchinbrook Island is 20 miles long, from 5 to 9 miles wide, and separated from the mainland by a channel from a half to 3 miles broad. Having for some time previously received interesting notes and imperfect material indicating the presence of a variety of small mammals, one of us (A. S. Le Souef) visited the island in September, 1928, accompanied by a party of friends, with a view to collecting a representative series of specimens.

The rugged, mountainous, and heavily wooded nature of the island unfortunately restricted field work to the foreshores, and the comparative richness of the fauna is indicated by the fact that during the brief sojourn several bandicoots (*Isoodon*) and five species of rats were secured. It is interesting to note that, according to observations and statements of the residents, there is a striking absence of all arboreal or carnivorous marsupials, such as phalangers and native cats, though these are numerous on the mainland.

Three of the four species of *Murinae* are of the naked, scaly, or mosaic-tailed variety, and are, apparently, subspecifically distinct from the mainland forms. Though the differences in some respects may seem slight, they are sufficient to indicate fairly prolonged isolation from the mainland. The somewhat complex affinities of the forms dealt with in the following notes, coupled with the uncertainty as to the number of species occurring in Queensland, appear to render the mosaic-tailed rats from Hinchinbrook of unusual interest and to warrant the separate treatment accorded them.

*MELOMYS LITTORALIS INSULAE subsp. nov.*

Apparently similar in colour to the typical form of the mainland, and differing most noticeably in the character of the tail, which has larger scales and is shorter than the head and body, instead of being considerably longer, as indicated for the typical subspecies.

The general colour of the fur of the back, which is soft, fine, and close, is a brownish cinnamon resulting from the cinnamon band on the upper part of the fur and the pencilling of the sepia tips. On the under-surface the fur is pale grey basally, tipped with light pinkish cinnamon (Ridgway) which is warmest on the throat and chest. Ear conch dark sepia externally, sepia within. Pes sparsely covered with very pale pinkish cinnamon hairs. Manus with a narrow bar of sepia extending on to the outer metacarpals. The tail, which is medium brown above and yellowish below, is from 5-12 mm. shorter than the head and body in three adults preserved in alcohol, instead of being about 22 mm. longer, as measured in the holotype skin of the typical form; the scales differ in being somewhat larger, averaging 13-14, as opposed to 18-19, rings to a centimetre.

Skull dimensions differ but slightly, and in the absence of any description of the skull, or specimens of the typical form, it is not clear if definite differences exist.

Dimensions (holotype in alcohol): Head and body, 128; tail, 112; hind-foot, 25.5; ear length, 14.3; breadth flattened, 13 mm.

Skull: Greatest length, 30.2; condylo-incisive length, 27.8; zygomatic breadth, 15.4; nasals, 10.7; interorbital breadth, 4.3; palatilar length, 13.4; breadth of brain-case, 13; palatal foramina, 5; upper molar series, 5.9.

Habitat: Hinchinbrook Island, near Cardwell, north coast of Queensland.

Holotype: Adult male, registered Aust. Mus., No. M. 4382. Other specimens are female allotype and six paratypes.

In his description of the typical form, Lonnberg (1) refers to the possibility of it being a dwarfed littoral race of *M. cervinipes*, and that it differed very plainly in being much smaller and slenderer in every respect, thus resembling the group of small *Melomys* forms described by Thomas at various times. Examination of the series of *M. littoralis insulae* from Hinchinbrook Island, and comparison of their external and cranial dimensions with those of the typical form and *M. cervinipes* from Queensland, leave no apparent doubt that *littoralis* is a distinct form allied to the small *M. australis* of Cape York and *murinus* of Murray Island, rather than to the larger *cervinipes* or *banfieldi*. It differs from the equally small *australis* and *murinus* in having a longer tooth-row and nasals; from the former it also differs in lacking the variable line of white along the middle of the belly, and lacks, correspondingly, the white undersurface of *murinus*.

The specimens were only taken adjacent to some high grass, known as "blady grass," about 3-4 ft. high, in which they built nests fairly well up amongst the stems; the nests were circular, about 5 in. in diameter, and of similar size to a blue wren's nest.

*MELOMYS CERVINIPES PALLIDUS*, subsp. nov.

An insular race which is very closely allied to *M. c. eboreus* from Ravenshoe, North Queensland, altitude 2,900 ft., but apparently differing in more completely lacking the reddish coloration above, and in being more buffy beneath, while the tooth-row appears to be slightly shorter.

General colour of the fur above, which lacks the woolly texture of a New South Wales specimen of *cervinipes*, is composed of a short tipping of light pinkish cinnamon, interspersed with a pencilling of blackish-brown from the tips. The sides are buffy grey, the belly being washed with light pinkish cinnamon, most noticeable on the sides; there is a whitish strip down the centre of the chest and a similar area about the inguinal region. Ear a little smaller than in *eboreus*.

Skull dimensions similar to those of *eboreus*, agreeing in being smaller than those of the typical form; tooth-row a little smaller than in the allied subspecies.

Dimensions of the holotype in alcohol: Head and body, 136; tail, 144; hind foot, 28; ear, 17.5 mm.

Skull: Greatest length, 34; condylo-incisive length, 31.4; nasals, 11.3; interorbital breadth, 5.3; palatilar length, 15.2; breadth of brain-case, 14.2; palatal foramina, 6.2; upper molar series, 6.5.

Habitat: Hinchinbrook Island, near Cardwell, Queensland.

Holotype: Adult male, registered No. M. 4379. Other specimens, allotype female, and one juvenile.

In the absence of topotypical material of *Melomys banfieldi*, described by de Vis from Dunk Island, Thomas (A.M.N.H., 1913) regarded that form as doubtfully distinct from *M. cervinipes*, but later (A.M.N.H., 1924) referred to "The rather smaller *M. banfieldi*, de Vis, with whitish under-surface, occurring commonly on the Cape York Peninsula," and remarked that, lacking material, "it is just possible that the Cape York animal may prove different." He also expressed the opinion that Lonnberg's *littoralis* would seem to be referable to *banfieldi*. Whether *banfieldi* occurs at Cape York or no, there is apparently no doubt that it represents a distinct, if closely allied, species from *cervinipes*; dimensions of two Dunk Island adults show them to possess relatively shorter ears and longer nasals than

in *cervinipes*, while the coloration of the back appears to be generally much richer, being from ochraceous-tawny to sayal, pencilled with sepia to mummy-brown. The coloration and proportionately longer nasals markedly distinguish *banfieldi* from the adjacent insular form, *M. cervinipes pallidus*. The teeth of the two insular forms, however, agree in being smaller than the mainland subspecies of *cervinipes*. It has already been shown that the dimensions of *littoralis* distinguish it from *cervinipes*; comparison of its dimensions with specimens of *banfieldi*, quite apart from colour, also leave no doubt that Lonnberg's species is distinct from the latter.

*UROMYS MACRUPUS EXILIS* subsp. nov.

Differentiated from *U. sherrini* and allied to *U. macropus* by the character of the interorbital region and ridges on the cranium, as well as by the longer skull and hind feet. Distinguished from the typical Cape York form by the comparatively greater breadth immediately behind the rudimentary postorbital projections, and between the ridges on the parietals, as well as by the warmer yellowish-brown coloration, whiter under-surface, and somewhat shorter tail.

General colour of the back mainly bright yellowish-brown, composed of ochraceous-tawny on the shoulders and about clay colour on the rest of the back, intermingled with shining blue-black and blackish-brown hairs, which are thickest on the centre of the back and sides of the shoulders. Sides buffy-grey; snout, from between eyes to its tip, and on sides, of a drab buffy-grey; limbs buffy-grey; manus and pes white. Under-surface creamy white. Tail proportionately somewhat shorter than in the mainland forms.

The character of the orbito-parietal region definitely allies this form with *U. macropus*, while development laterally of the interorbital edges caused by the greater flattening and overhanging of the orbits, as well as the even greater width between the rudimentary postorbital projections and between the ridges of the parietals, separates this form subspecifically from the typical Cape York form of *macropus*. The upper profile of the skull is noticeably less bowed than in two Cape York specimens, in which there is a decided hump or convexity in the naso-frontal region, not present in the insular skull. Tooth-row slightly shorter than in the two mainland examples.

Dimensions of the holotype in alcohol: Head and body, 276; tail, 314; hind foot, 60; ear, 30 mm.

Skull: Condylar-incisive length, 68.5; zygomatic breadth, 36.3; nasals, 26.4; frontal, breadth at middle of orbital (not orbito-zygomatic) fossa, 11.6; breadth immediately behind rudimentary postorbital projections, 16.4; greatest breadth between ridges on parietals, 20.4; palatilar length, 36.5; palatal foramina, 8.5; upper molar series (worn), 12 mm.

Habitat: Hinchinbrook Island, near Cardwell, Queensland.

Holotype: Female adult, registered Aust. Mus., No. M.4378. A single specimen.

Comparison of the above dimensions of the orbito-parietal region with those of *U. sherrini* shows them to agree with the condition described by Thomas for *U. macropus*. The shortness of the sparse fur of the back also distinguishes this subspecies from *sherrini* from an altitude of 2,900 ft., while the warmer coloration and shorter tail separate it as a subspecies of the latter.

Regarding habits, Lonnberg has recorded the capture of a female from Milla-Milla, Northern Queensland, "from the nest in the top of a hollow, rotten tree." Collett wrote of *U. macropus* as being "not uncommon in hollow trees in the plains, where they are eaten by the natives." Thomas has suggested that the forms listed by both authors are probably



synonymous with his *sherrini*. In our opinion, this is probably so regarding the highland Milla-Milla specimen, but the specimen from the plains about Herbert Vale, recorded by Collett, by virtue of locality and greater length of the skull, appears reconcilable to *U. macropus*.

The Hinchinbrook form lives almost entirely on the coast, feeding mostly on the introduced cocoanuts which the residents have great difficulty in keeping from them; there were abundant signs of the powerful teeth having gnawed through the shells, while coconut was the only bait successfully used for them.

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OCURRENCE OF THE CRAB-EATING SEAL *LOBODON CARCINOPHAGA*  
HOMBRON AND JACUINOT, IN NEW SOUTH WALES.

By A. S. LE SOUEF, C.M.Z.S.

Plate xi., fig. 2.

The Crab-eater, or, as it is sometimes called The White Antarctic Seal, is an inhabitant of the southern seas, round the Antarctic Continent. It has been noted on Graham Land and in the vicinity of the Bay of Whales, and is fairly numerous at times on the coast of Patagonia. Whilst the Sea Leopard (*Ogmorhinus leptonyx*) is not infrequently reported off our coasts during the winter months, the Crab-eater is very rare in our coastal seas, for, as far as can be traced, there are only two previous records of it having come ashore in Australia. This particular specimen came on to the Manly beach early in July, 1929, and was secured by the Taronga Park Trust. It lived only until the 23rd idem.

The general colour is silvery-cream, shining in the sunlight, mottled with dark grey on the sides of the neck, flanks and lower part of the body. The hind flippers are blackish-grey. Tail spatulate, about five by two inches. Eyes large and black.

Its movement on land is slow, and it can only progress by a series of jerks, there being no lifting power at all in the flippers. In the water, however, it is very much at home and very graceful. The call is not very loud, resembling that of a calf.

Naturalists in Antarctica have been puzzled as to the origin of scars on the bodies of seals. A leopard seal that came ashore last year had large curved marks on the body that seemed to have been made by the jaws of a shark. The specimen under review had two deep scars on the flank, as well as some punctured wounds, possibly caused by the canine teeth of another seal.

The teeth of this seal are of a very peculiar shape, being rather flat, with several lobes. It is supposed to feed on small crabs and shrimps, the teeth probably acting as sieves to allow water to escape while retaining the crustacea in the mouth.

The specimen was in an exhausted condition for several days and ignored fish, such as are eaten greedily by the captive furred seals. Later, when the fish were taken by it, the method of feeding was peculiar in that it removed the skin of the fish, ate the flesh and left the bones and head intact. It is, of course, not clear as to whether this method of eating fish was due to the exceptional conditions of captivity, or if fish would be eaten to any extent in the wild state; sheer hunger at the absence of usual diet may have influenced the animal to eat the fish. It is notable that the captive took no interest in dead shore crabs, indicating that small brit-like pelagic crustaceans, far removed from ordinary littoral forms, are its usual menu.

Admiral Evans, who had experience in the Antarctic, informed me that the stomachs of all specimens of this seal examined by him contained the small crustacea commonly called "Brit" (*Euphausia* spp.) by the whalers.

## INTRODUCTION OF THE GREAT CARP *CYPRINUS CARPIO* INTO WATERS OF NEW SOUTH WALES.

By DAVID G. STEAD.

In his "Additions to the Check-List of the Fishes of New South Wales, No. 2," on page 356 of the present volume of this journal, G. P. Whitley records *Cyprinus carpio*. Mr. Whitley's record is based upon a specimen which died in captivity in the aquarium at Taronga Zoological Park, Sydney, and which had come from one of the ponds at Prospect, New South Wales. As no record of the origin of the present stock at Prospect has been published in any scientific journal, it appears to be desirable to here set down some details.

As at present existing in their semi-wild state at Prospect these carp consist of True, or "Scale," Carp and King, or "Mirror," Carp—with, probably, a certain number of the scaleless forms known as Leather Carp. Though existing now in fairly large numbers, they all originated from a few specimens brought into this State in 1907 and 1908.

In the year 1907, considerable interest was being taken in Sydney in the formation of small private aquaria. Incidentally, this led to the founding of the first Aquarium Society, in the same year. From this period onwards many kinds of fishes suited to aquarium keeping were imported by individuals and by various shopkeepers. Among the species brought in were many kinds of cyprinoids of Europe and Asia; eels, catfishes, climbing "perch," gurami, fighting fish (*Betta*), paradise fish, and others from south-eastern Asia, several kinds, including Medaka or rice-fish, from Japan, catfishes, poeciliids, (or "top minnows"), cichlids and others from Central and South America. In very few instances did the possessors of the fishes know anything about them as regards identity or their relationships; and this led to a very great confusion of names and the application of some extraordinary names, which to-day are found among aquarium keepers in this country. Such names as "Mouth-breeding Carp" for fishes entirely dissimilar to the members of the carp family, and "Life-bearing Carp" for some of the viviparous killifishes, are among these.

One day as I was examining the fish stocks of a bird and animal dealer at a shop in George Street, Sydney, right opposite Bridge Street, I noticed among several hundreds of plain and golden carp *Carassius auratus*, of from two to four inches in length, a few which possessed the typical barbels of *Cyprinus carpio*. A close inspection of these revealed that they were indeed of the species named, and which is known variously as "Asiatic," "Prussian," "German" and "Common" Carp, in literature. Twelve of these, ranging from two to two and a half inches in length, were secured—at a cost, it may be mentioned, of sixpence each. This was December 11, 1907.

Nine of these small carp were sent to Prospect, where they were placed in what was known as No. 1 pond, in the series known as the Bloxsome Ponds—frequently termed the "inlet" ponds, because of their situation at the point where the water for Sydney water supply passes from the canal into the Prospect Reservoir. Three of the carp were kept in small aquaria by myself for several years. Three years afterwards, when some of the carp at Prospect had attained to as much as five pounds in weight, these were (though quite healthy) only about three inches in length and weighed about one ounce! This is worthy of mention, as indicating the effect of environment upon a most adaptable fish.

All of these carp, it should be mentioned, were of the variety called True Carp or Scale Carp, because of the whole body being covered with scales—as in normal wild examples.

On November 2, 1908, I obtained (under very similar circumstances to those previously mentioned) six very small specimens of the Mirror or King Carp. This is the variety in which the skin is partly naked and partly covered with extraordinarily large scales. (A further variation of this is the Saddle Carp, in which there are large plate-like scales along the back, while the rest of the skin is naked). These Mirror Carp were about two inches in length. These were transferred by me to a race in the trout hatchery; or, more correctly, to a race between two of the trout ponds, where they were hand-fed for about a year and a half.

I now quote from a "Report upon two varieties of *Cyprinus carpio*: 'True Carp' and 'Mirror (or 'King') Carp' in the Department's Ponds at Prospect Reservoir," furnished by myself to the Board of Fisheries, on March 18, 1910. From this report also the foregoing information has been largely drawn. Speaking of the scaled carp, the report says:—

Upon visiting these ponds yesterday for the purpose of ascertaining the result and of ascertaining the species of carp present, I found that there were some large fish in No. 1 pond; and, upon watching them closely as they came to the surface, I was able to recognise them as the True Carp. I cannot say how many there are, but there appeared to be about half a dozen.

Considering the "smallness" of their surroundings and that they have subsisted upon the natural food, I was astounded at the progress that they had made. As far as I could judge (as they came repeatedly to the surface) they run from about 2½ to 4 lb. in weight. This speaks volumes for the size they might be expected to attain to in some of the western lagoons and billabongs. They have been in the Bloxsome Ponds for 2 years and 3 months.

As these large fishes came to the surface to take the floating food offered them they caused quite a swirl. They would be a great temptation to the line fisherman.

At the time of this visit no small fry of the species were seen, but, as later experience showed, they were actually present at that time.

The report further proceeds, in regard to the Mirror Carp, which had been placed in the trout race sixteen and a half months before:—

At the time of placing them there, these were only about 2 inches long. Now, notwithstanding the unsuitable conditions of their surroundings and that they have been hand-fed, they have increased enormously and they run from 12 to 15 inches in length—and, I should say, from about 2 to 3 lb. One is missing, as there are only five there now.

As the Scale Carp and the Mirror Carp were of the same species and would breed together, it was decided to place them all in No. 1 pond of the inlet series. Authority was obtained to thoroughly overhaul these ponds—in some of which Murray Cod and Australian Bass (Eastern "Freshwater" Perch) were being kept—and, in the course of this it was discovered that some of the Scale Carp ran to about five pounds in weight, while there was evidence of breeding in the presence of a number of small fry. After the whole of the stock had been placed together, a system of regular hand-feeding was instituted, to prevent the carp from destroying their own spawn—or, at least, to mitigate the trouble. In 1911 a woman caretaker was appointed to the charge of these ponds. The food given to the carp was mainly bread, supplemented at times with a little minced bullock

heart and liver. In addition to this the fish obtained large numbers of the small freshwater shrimp and of aquatic insects.

It is rather of importance to say that it was at this stage that the name of "Crucian Carp" was applied in his reports by an officer of the Department to the fish under consideration, and was picked up by some of the residents at Prospect—hence the present tendency on the part of some people there to call the fish by that name. But at no time were any true Crucian Carp at Prospect, so far as is known. I have thought it necessary to point this out, because Mr. Whitley mentions that it was sometimes known at Prospect by that name.

The Bloxsome Ponds, I might mention, were the original trout ponds, many years ago, at Prospect. After the Prospect hatchery and trout ponds were constructed, however, the Bloxsome Ponds fell into disuse, and were given over to a dense growth of weeds and water plants. Their natural fish population up to the time of the introduction of the specimens of *Cyprinus carpio* consisted of numerous examples of the little carp and goldfish *Carassius auratus*, the perch known as Australian Bass, the Minnow (*Galaxias*), the Carp-Gudgeon, *Carassiops compressus*, the Striped Gudgeon, *Mogurnda australis*, the Flat-headed Gudgeon, *Philypnodon grandiceps*, and the Common Eel.

#### A NEW LORICATE FROM QUEENSLAND.

By JOHN S. MACKAY, M.D.,  
Melbourne.

ACANTHOCHITON PELICANENSIS *sp. nov.*

Plate xi.

The author spent a week in August, 1928, at Emu Park, a seaside resort some 30 miles from Rockhampton, in Queensland. This spot is of note as the type locality of that beautiful loricata *Rhyssoplax venusta* Hull.

In Keppel Bay are a number of islands. One of these, known as Pelican Island, lies about four miles from the mainland, and is well sheltered on the east by the large North and South Keppel Islands.

Pelican Island is visited two or three times a week by the fishermen who gather oysters. The tides being favourable, advantage was taken of one of these trips to pay a visit to the island on August 15, 1928.

The island appears to be of basalt formation, largely weathered, and might cover fifteen acres, rising to a hill of a hundred feet or so. It is well covered with lantana and other scrub, and there are several patches of prickly pear, which grows well down to the level of the spring tides.

The basalt rocks on the foreshores are plentifully covered with oysters, and in the interstices are numerous specimens of the emergent loricata *Liolophura queenslandica* Pilsbry.

A shallow muddy pool at about half tide level on the south side of the island was thoroughly searched. Here were taken specimens of what a glance proclaimed to be something new.

Only three specimens were taken, two measuring  $7\frac{1}{2} \times 3$  mm. The third was  $5\frac{1}{2} \times 2$  mm.

Family CRYPTOCONCHIDAE.

Genus *Acanthochiton*.

Type locality: Pelican Island, Keppel Bay, near Emu Park, Queensland.

Description: Shell small, elongate oval, elevated, keeled, slightly beaked, side slopes flattened. Colour yellowish white, darker on jugum.



Anterior valve, sculptured with 18 to 20 boldly elevated, nodulose, converging ribs, the nodules being convex and coalesced. A proportion of these ribs do not reach the apex, and some appear to end abruptly at varying lengths, forming a definite and characteristic pattern of "longs" and "shorts."

Median valves, central and lateral areas not differentiated, but sculptured as in anterior valve. Those lirae closest to the mid-line are composed of smaller pustules and run longitudinally. The remainder diverge fan-wise so as to run radially at the posterior margin. The same pattern of "longs" and "shorts" is observed.

Posterior valve, jugal area wedge-shaped and sculptured with six lines of convex pustules, diminishing in size towards the mucro, which is situated at the posterior two-thirds.

Post-mucronal area concave, sculptured with about ten ribs on each side similar to those on anterior valve, but radiating from mucro and becoming smaller and less distinct posteriorly.

Girdle of medium width and leathery. Definite though meagre sutural tufts present.

Interior white. Slits 5-1-2. Posterior valve faintly inter-slit and sinuate. Sutural laminae resemble those of *granostriatus* series. Sinus wide.

Dimensions:  $7\frac{1}{2}$  x 3 mm. (type, dried and slightly curled).

Station: Under stones in a shallow muddy pool at half tide level.

Remarks: The two larger specimens were reserved for type and disarticulated co-type, and have been presented to the Australian Museum.

Identification: The slitting and girdle at once place this shell in the family CRYPTOCONCHIDAE.

Under the artificial separative scheme given by Iredale and Hull (Monograph of Australian Loricates, page 65) this shell would fall into genus *Acanthochiton*. Whilst agreeing generally with this genus, it does not conform to any of the various series into which the genus is divided.

In general outline, as well as in the internal features, it approximates to the series of *A. granostriatus*. The same peculiar fan-shape of the individual valves and the tendency for the valves to separate from each other at the lateral margins may be noted in several members of this series.

The slitting and shape of sutural laminae also agree with *A. granostriatus*, but the spiculate girdle is lacking and the sutural tufts are sparse.

Apart from the possession of a leathery girdle it does not resemble the series of *A. sueurii*.

It is placed accordingly in the genus *Acanthochiton* as the type of a new series.

The sculpture of the anterior valve is decidedly stronger than that of the other valves. Some of the short ribs under magnification of 70 diameters are shown to arise by divarication. In other instances (and particularly on the median valves) the shorter lirae end abruptly at varying lengths. Some run only a quarter of the way; others from a half to two-thirds; whilst a few taper out to the apex. Examination of a larger series may show this appearance of "longs" and "shorts" to be a phase of growth.

NOTE ON THE OCCURRENCE OF A SECOND SPECIES OF FRUIT-BAT  
(*PTEROPUS SCAPULATUS*) IN NEW SOUTH WALES.

By ELLIS LE G. TROUGHTON.

(By Permission of the Trustees of the Australian Museum.)

Some time ago, while working through the collection of local *Pteropus* in the Australian Museum, a specimen of *Pt. scapulatus* was discovered, from Gosford, about 30 miles north of Sydney, which had been incorrectly registered and labelled as *poliocephalus*. As the former was not considered to extend farther south-east than Rockhampton, Queensland, I was about to record the extension of range when my friend and colleague, the late Allan R. McCulloch, advised that it would be better to await additional material, feeling that the occurrence of the single specimen so far south of its known range implied that there had possibly been an error in registration.

By a coincidence, confirmation came from entirely different sources at the same time, early in 1927, when a specimen of *Pt. scapulatus*, which had been secured at Wellington, New South Wales, was sent in for identification by Mr. C. Fahey, who presented it to the Museum. Additional evidence was contained in a very interesting letter from the late H. L. White, of Belltrees, Scone, which indicated that large camps of this species had occasionally been established near his home, though not observed there since 1917.

Regarding the small red "foxes" which were evidently *Pt. scapulatus*, the following interesting extract may be quoted from Mr. White's letter, which gave the necessary permission for publication: "Some years ago I was in correspondence [May to August, 1916] upon the subject of the flying fox with Sir Baldwin Spencer, of the National Museum, Melbourne, and sent him a couple of specimens of a small bat, shot in my fig trees at Belltrees, and new to me." After explaining that these were identified as juveniles of the common species, Mr. White says that he had seen hundreds of young *Pt. poliocephalus* and felt sure he was not mistaken in considering them to be different.

His letter continues: "I received confirmation from an unexpected quarter, a Mr. Wyndham, of Tamworth, writing me [October 27, 1916] to say a camp of small red foxes had established itself in the district. Sir Baldwin sent him a tin of spirits for specimens, but before same arrived the camp left. I never got any satisfaction and I am still puzzled about the species; the bat is much smaller than our common species, with dark reddish brown body."

The remarks on size and the colour left little doubt that both the small Tamworth and Scone specimens were *Pt. scapulatus*, the identification being even more definitely warranted by the occurrence of the specimens at Gosford, which is about 60 miles south of Scone. The definite identification of the specimen from Wellington, nearly a hundred miles west of Scone, is interesting, both as further indicating the probability of *scapulatus* occurring at Scone and Tamworth, and in supplying a record from unusually far inland. The following general notes on the history, diagnostic characters, and range of the species may prove useful to those interested in the local fruit-bats from the scientific or economic point of view.

The species was described by Peters in 1862, the type specimen being an adult female from Cape York, now in the Berlin Museum. The single synonym, *Pteropus elseyi*, was made by Gray in 1866, founded on specimens from Claremont Island, north-east Queensland; the description of

*scapulatus* was known to Gray, who erroneously considered it allied to, if not identical with, *poliocephalus*. Matschie and Trouessart included *scapulatus* in the subgenus *Spectrum*, an arrangement rejected by Andersen in his "catalogue."

Differential characters: Apart from colour, the size, teeth, and comparatively naked tibia readily distinguish the species from *poliocephalus*, the only fruit-bat hitherto considered to enter New South Wales. The forearm length ranges from 131-143 mm., as opposed to an average length of 160 mm. for *poliocephalus*, while the lower leg is quite naked above and beneath, excepting immediately below the knee, whereas in *poliocephalus* the tibia or lower leg above is thickly clothed to the ankle with unusually long hairs, and its undersurface is densely haired to a short distance from the ankle. The furring or otherwise of the tibia thus supplies a quick and extremely simple means of distinguishing between the two local species.

As Anderson has pointed out, *scapulatus* is readily distinguished from any other known species of *Pteropus* by the combination of these two characters: Cheek-teeth excessively narrow, ears long and pointed. It is the only medium-sized (forearm 131-143 mm.) species with degenerated cheek-teeth, the three others of the genus with similar teeth, *subniger*, *personatus* and *woodfordi* being very small (forearm 86-99). Of these, *woodfordi* of the Solomons is most nearly allied to *scapulatus*, but it is a short-eared species.

The colour of the body fur is dark reddish brown, sometimes grizzled with paler tips, the head is a grizzled grey-brown, the collar cinnamon or russet, and the hair on the undersides of the wings pale straw-yellow. In some specimens an ill-defined spinal stripe divides the mantle or collar into a right and left "shoulder-patch," probably inspiring the name *scapulatus*. The males have glandular neck-tufts on each side in front of the shoulder, composed of rigid buff-coloured hairs.

Range.—Besides the New South Wales specimens, *scapulatus* is represented in the Australian Museum collection by two skins from Broome, north-western Australia, which were received in exchange from the Perth Museum, labelled as *gouldi*, and its synonym *funereus*, Cape York, and some excellent specimens collected near Rockhampton in 1925 by Mr. Anthony Musgrave, of the Museum staff.

The species has been recorded from the Fitzroy River in the Kimberley division of Western Australia, the South Alligator River in Arnhem Land, and from numerous coastal localities in Queensland, from Cape York and Thursday Island to as far south as Mackay. The occurrence of the species almost to the Sydney district in New South Wales thus greatly extends the already huge range of the form. One would naturally expect to find some differences, at least of subspecific importance, between the western and eastern specimens, but careful comparison of external and cranial dimensions of the Museum material with those listed by Andersen showed no material differences; it may be noted that that author had specimens from Kimberley, Western Australia, Arnhem Land, and Queensland, which he regarded as representative of but one form.

The Gosford specimen, received in 1903, and the Wellington one, were doubtless either taken or were stragglers from camps similar to those noted at Scone and Tamworth. Fruit-bats are often reported from the Hawkesbury district, and it is very probable that *scapulatus* occurs in New South Wales, at least as far south as the Hawkesbury River, and inland as far as Wellington, far more often than one would suspect. The fact that laymen rarely differentiate between bats of comparatively similar form and size, or retain specimens from bat-shoots for the Museum, would apparently explain the absence of records hitherto.



It is interesting to note that in the correspondence cited above, Mr. White controverted the belief, expressed in most popular works, that the fruit-bats or "flying-foxes" may cling to one another in camp. He wrote: "I have observed many camps containing many thousands of bats, but never saw them clinging to each other; in fact, they are such bad tempered quarrelsome beasts that I feel sure the idea is wrong. In a very large camp the bats are frequently seen in festoons from tree to tree, but always hanging on a vine or pliable branch, the latter bending over when fully laden, while in a fine series of photos taken near my home at Bell-trees the bats are in no case shown to be touching." In response to the inquiry of one possessed of such considerable experience, I could only say that statements of their clinging together have usually been attributed to excessively crowded conditions, and expressed the hope that those in a position to make first-hand observations may be able to clear up the point. There is no doubt, however, to my mind, that Mr. White's contention is correct, especially in view of the irritable nature of the creatures, reports to the contrary probably being due to a misconception of the "festoons" which he describes.

Writing of a specimen of *scapulatus* from Chillagoe, in the Cairns district, which he presented to the Museum, Mr. W. D. Campbell says: "There were dozens of them to be seen hanging to the top branches of trees along the creek . . . but they did not stop long, about a fortnight, and then moved on somewhere. The flying opossums also seem to have departed." The range of the larger *poliocephalus* extends from Cape Howe in Victoria to Cape York, and is therefore more restricted than that of *scapulatus*. Frequent and rapid migrations are typical of the two species, and, as it is known that different kinds of fruits are favoured by different forms, there is an interesting course of investigation suggested, in which observations may indicate why their range overlaps for a certain area in eastern Australia, *poliocephalus* extending much farther south, and *scapulatus*, equally independently, reaching right across to the north-western coast.

The economic importance of these mammals as pests is well known, and the notes are published in the hope that they may even slightly assist workers engaged in studying habits and migrations with regard to the economic importance of the subject.

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#### A BAT COLONY.

Mr. Albert De Lestang writes to Mr. A. S. Le Souef from Adel's Grove, Burketown, North Queensland:—

"Since coming to this part of the Gulf of Carpentaria I have noticed two or three species of rare parrots at long intervals which I cannot place in the list of our birds. Recently I watched a pair of these handsome but rare visitors at the topmost of the highest gum amongst other giant trees, and concluded that they had young somewhere in the tree. It was not this alone that kept me watching them, but their seeming frenzy at some object I could not see or guess at. It was a giant river gum of immense girth, to all appearance sound, not a dry branch visible, but I concluded otherwise, as a characteristic of this variety is that they are always more or less hollow. I therefore swung my axe at the bole, and when the tree crashed down, its limbs in hundreds of pieces, a writhing mass of squealing miniature piglets poured forth! Thousands of little bats swarmed the ground, seeking shelter. Hundreds of them scrambled over me, worming their way into my clothes, biting and scratching me badly in their struggles. In much less time than it takes to write I backed from their



midst, but not until I had unwillingly killed or wounded many. These little creatures are useful insect destroyers. I think that not more than 30 or 40 flew away, the remainder eventually crawling back into the broken hollow limbs thrown about the ground. Some of these broken pieces were over 12 feet in length, with pipe 18 inches in circumference, packed tight with these little animals. The bole was a huge pipe, the hollow over five feet in diameter, in parts filled with the bats. By same mail I am posting two of these little bats, thinking they may prove of interest to you or some of the Museums. Look at their pig-like face, at their pleasing features. Are they not winning creatures?"

The bat has been identified by Mr. E. L. Troughton as *Chaerephon plicatus colonicus* Thomas.

## CHECK LIST OF THE AUSTRALIAN BUPRESTIDAE.

Vide vol. v., pp. 265-304.

## CORRIGENDA.

- 17. *terraereginae* for *terracreginae*.
- 178. *pygmaeus* for *pygmacus*.
- 209. *cylindrica* for *cylindricus*.
- 404. *chalcodera* for *chaleodera*.
- 407. *donovani* for *donorani*.
- 478. The three synonyms *alacris* Kerr.  
                                   *libens* Kerr.  
                                   *quadrinotata* Blkb.  
       should be under 478 *alternecosta* Thoms. instead of under 480.
- 549. *dilatata* for *dilataticollis*.
- 644. 1838 for 1868.
- App.: p. 302. *Chrysobotris* for *Chrysobolris*.  
                   *jakovlevi* for *jakavlevi*.

## ADDENDA.

- Nascio parryi* Hope, Tr. Ent. Soc. Lond., 1845, 103. . . . . N.S.W., V., T.
- Castiarina amplicollis* Saund., Jour. Linn. Soc., 1868, 480. . . . . N.S.W.
- Castiarina canaliculata* Blkb., Roy. Soc. S.A., 1892, 51. . . . . Q.
- Castiarina dulcis* Blkb., Roy. Soc. S.A., 1900, 41. . . . . T.
- colorata* Kerr., Ann. Soc. Ent. Belg., 1898, 141.
- Castiarina erythroptera* Boisd., Voy. Astral., 1835, 88. . . . . All States.
- Castiarina klugi* L. & G., Mon., 1839, 27. . . . . East Australia.
- Castiarina montigena* Oke., Linn. Soc. N.S.W., 1928, 28. . . . . V.
- Castiarina punctatosulcata* Saund., Ins. Saund., 1869, 480. . . N.S.W., V.
- litigiosa* Kerr., Soc. Ent. Belg., 1890, 45.
- Castiarina rubrocincta* Gehin., Bull. Soc. Mos., 1855, 13. . . . . W.A.
- Castiarina subgrata* Blkb., Roy. Soc. S.A., 1899, 157. . . . . N.S.W., V.
- campestris* Kerr., Ann. Soc. Ent. Belg., 1898, 139.
- Castiarina tropica* Cart., Linn. Soc. N.S.W., 1922, 72. . . . . Cape York.
- S. G. *HYPOSTIGMODERA* Blkb., Roy. Soc. S.A., 1892, 215.
- variegata* Blkb., l.c. . . . . Q.

## SYNONYMS OMITTED.

Under *Bubastes cylindrica*.

- var. *euryaspiloides* Obenb., Arch. f. Naturg., 1922, 82.
- var. *crassula* Obenb., l.c., 1926, 192.

- Under *Melobasis interstitialis* Blkb.  
*costata* Thoms. (n. praeocc.), Typ. Bup., App., 1879, 16.
- Under *M. vittata* Blkb.  
*affinis* Kerr., Ins., 1902, 159. Gen.  
*cupreovittata* Thoms., Typ. Bup. App., 1879, 22.  
*inflammabilis* Thoms., l.c., 19.  
*viridicollis* Kerr., Ann. Soc. Ent. Belg., 1898, 127.
- Under *Diceropygus suturalis* Macl.  
*? jacowleffi* Kerr., Gen. Ins., 1902, 158.
- Under *Pseudanilara cupripes* Macl.  
*var. occidentis* Obenb., Arch. f. Naturg., 1924, 69.
- Under *Castiarina atricollis* Saund.  
*var. deserti* Blkb., Roy. Soc. S.A., 1892, 36.
- Under *C. coeruleipes* Saund.  
*var. montana* Cart., Linn. Soc. N.S.W., 1916, 138.
- Under *C. versicolor* L. & G.  
*decemguttata* Gory., Mon. iv., 1841, 132.  
*parva* Saund., Ins. Saund., 1869, 26.
- Under *Cyphogastra woodlarkiana* Montr.  
*goryi* Boh., Eug. Reis. Zool., Vol. 2, 1858, 14.

*Note.*—As there still appears to be some doubt in the minds of some authors as to the validity of the names contained in a paper by Hope with the reference "Buprestidae, 1836," readers may be referred to the full discussion of this paper in Proc. Ent. Soc. Lond., 1867, pp. cix., cx. Also to Saunders' note (Tr. Ent. Soc. Lond., 1868, p. 2).

## OBITUARY.

### THE LATE ROWLAND ILLIDGE.

On Tuesday, February 19, 1929, at "Alcyone," Bulimba, Brisbane, there passed away in his seventy-ninth year, Rowland Illidge—one of the finest nature lovers of Australia and the first honorary associate member of this Society.

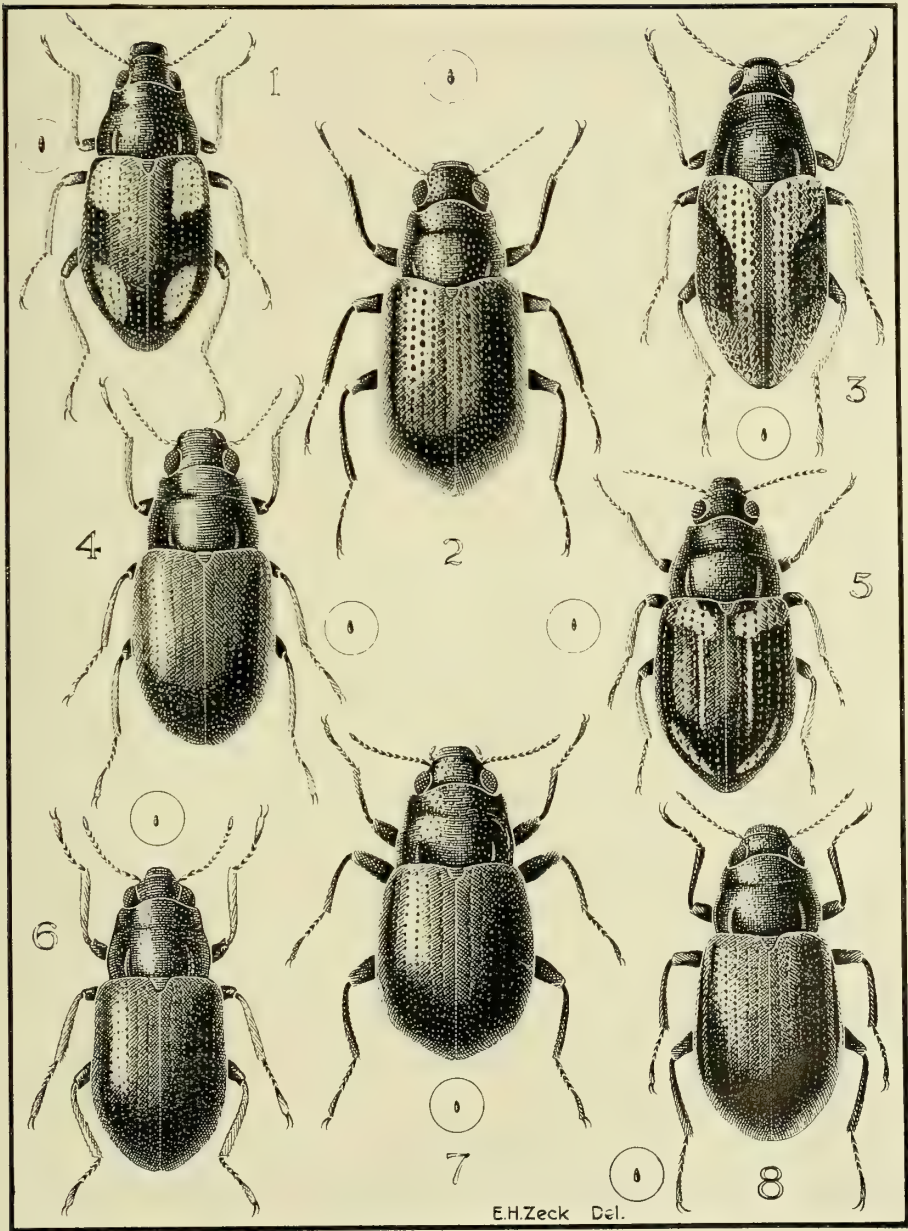
Rowland Illidge was born near London, and at the age of seven came to Sydney with his parents and lived at Newtown for two years before moving to Brisbane.

He was the kindest of men, but of a somewhat retiring nature, but to his friends he was always ready to pass on any interesting note from his vast store of knowledge, both of birds and insects. He had a personal knowledge of naturalists now long gone, and his accounts of them were always listened to with interest. He helped many entomologists in their work and for the last thirty years the writer has been much indebted to him for the gift or loan of specimens, and for many valuable notes. He was a delightful companion when collecting, where his experience was of the greatest value to his companions.

For the distinguished services he had rendered to natural history in Australia, on the institution of honorary associate membership, the entomological section of this Society unanimously recommended him as the first to receive this honour and the Council of our Society confirmed this.

His death is a loss to naturalists and a great gap has been left in Brisbane for those who always looked forward to seeing him when visiting there.

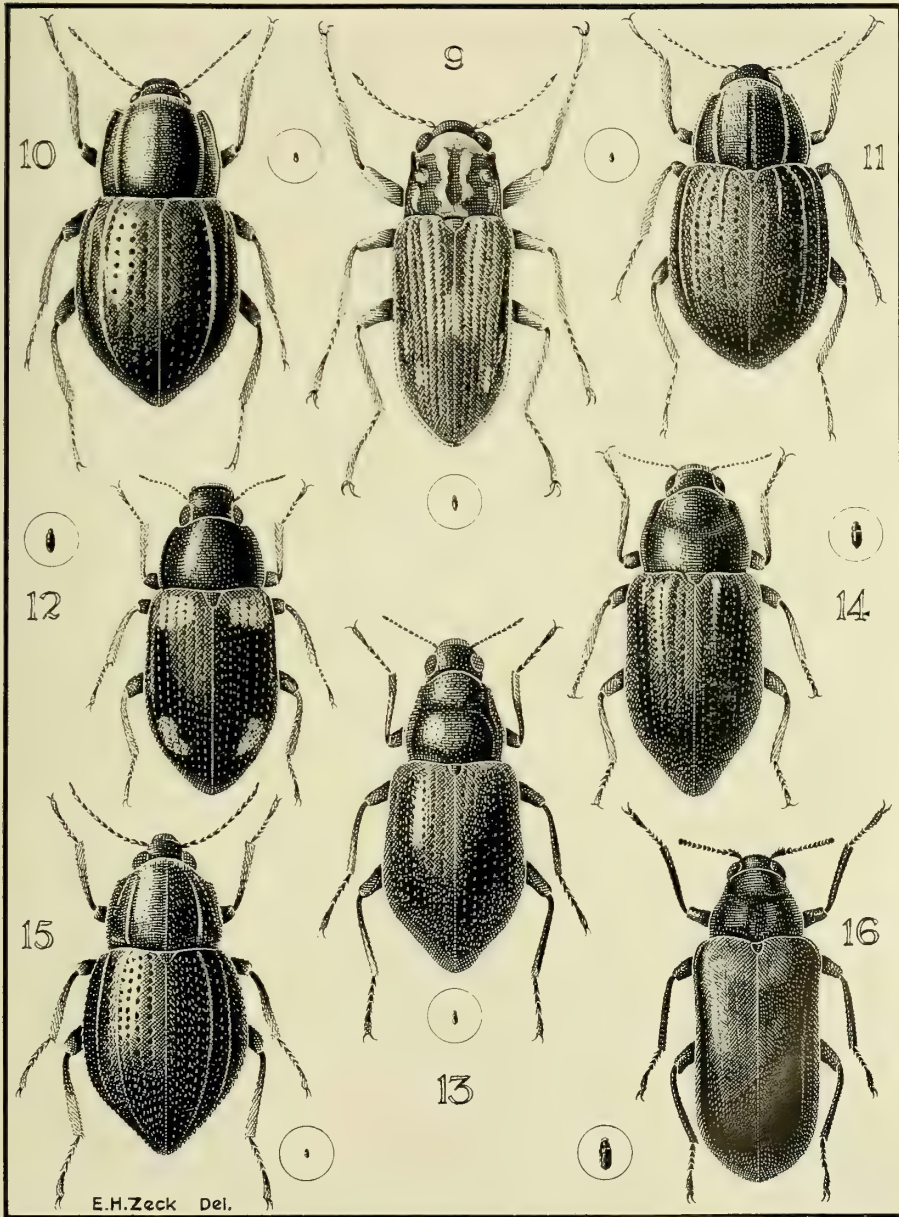
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AUSTRALIAN DRYOPIDAE.

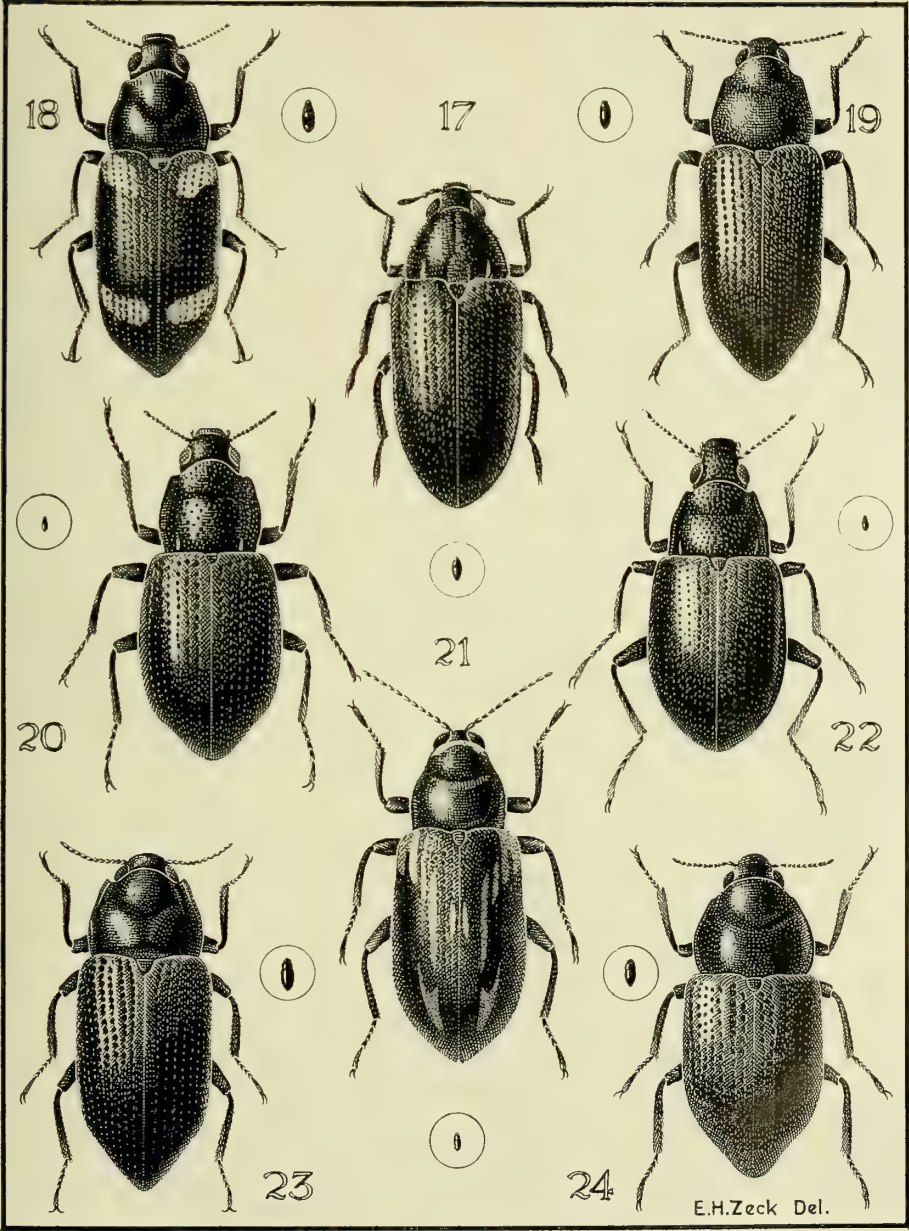






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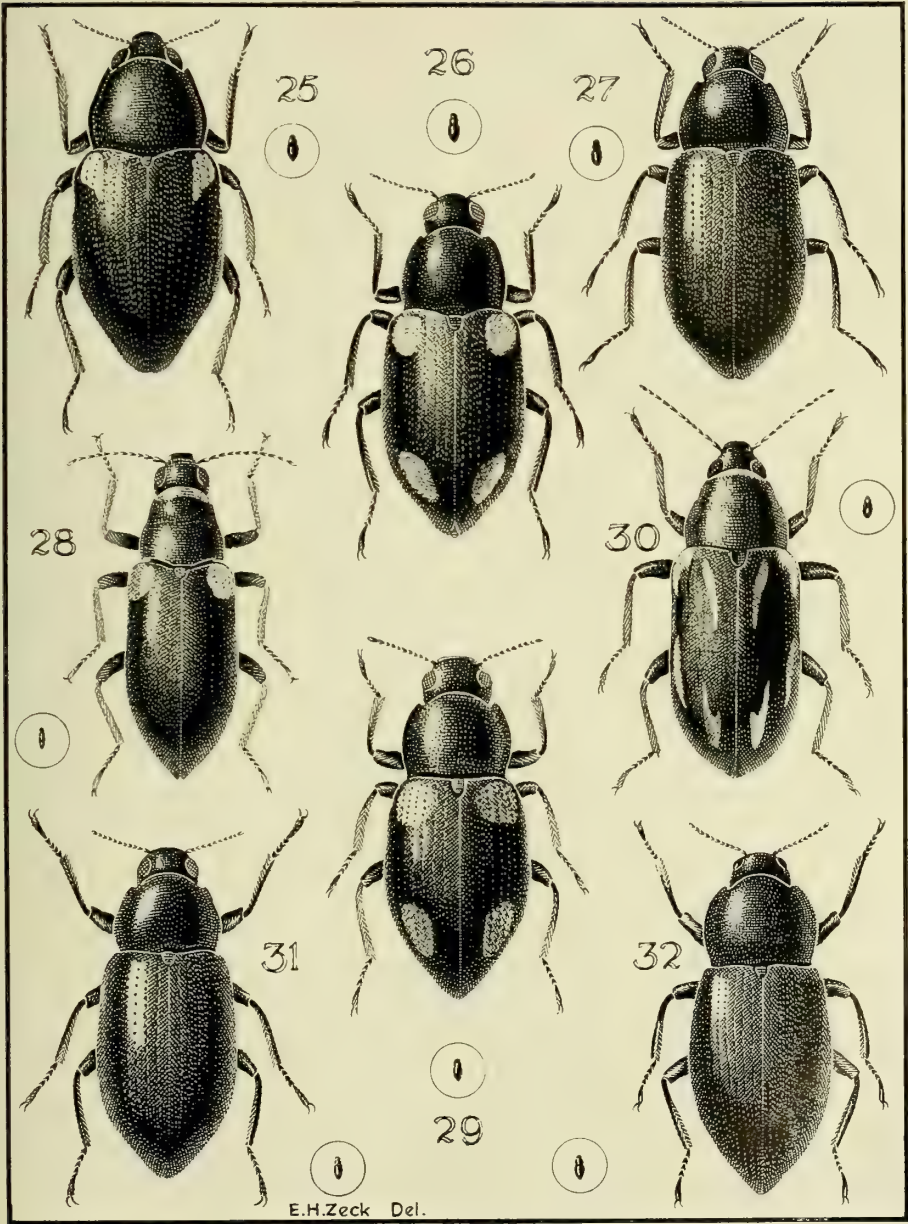




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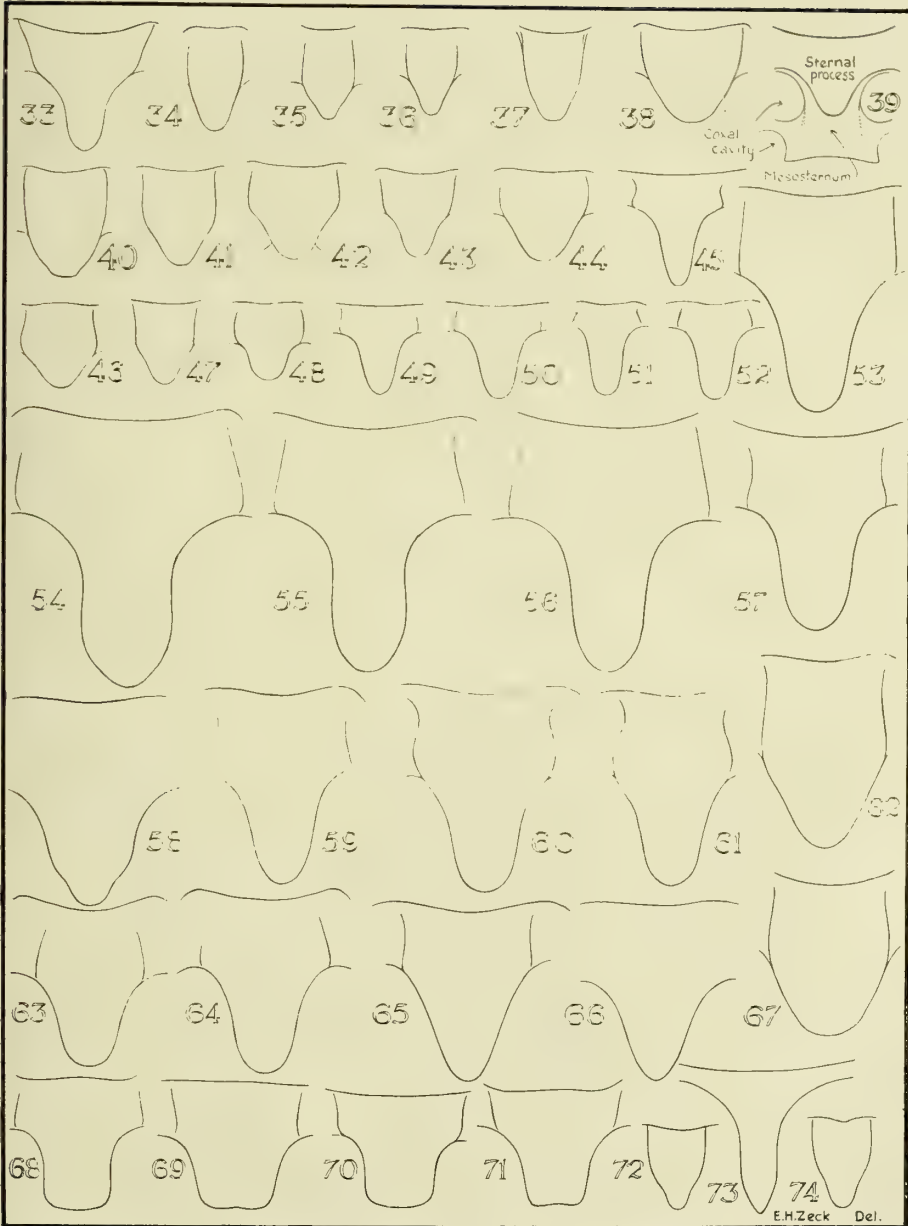






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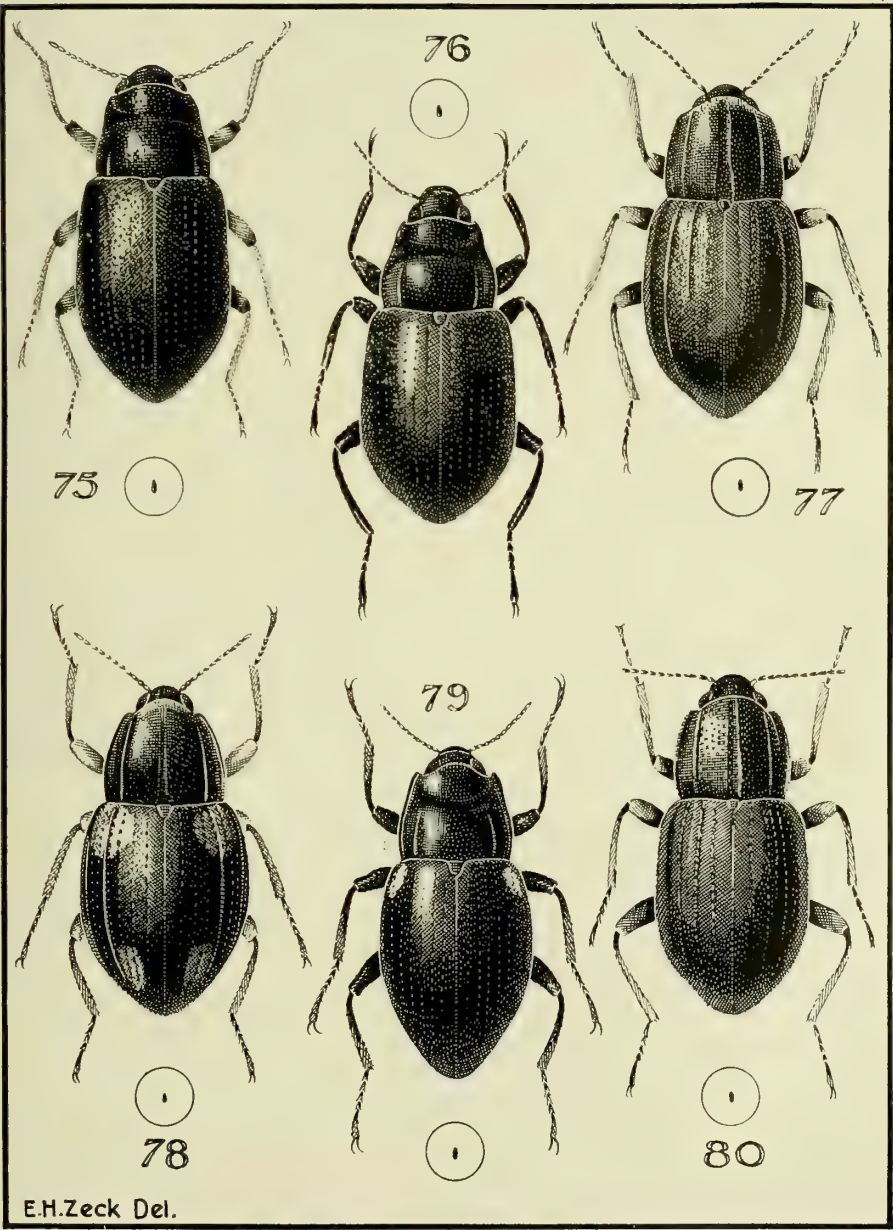




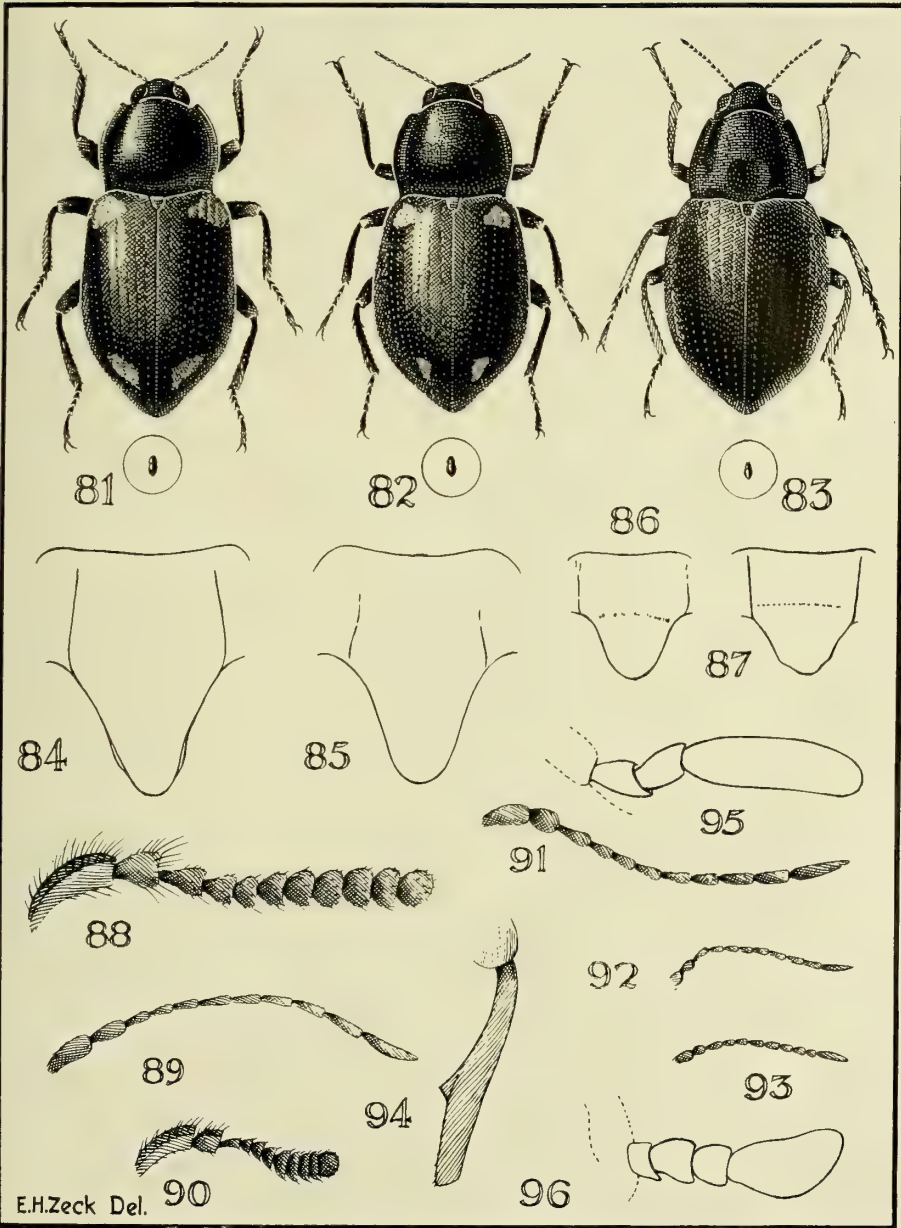
Prosternal processes of Australian DRYOPIDAE.

















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1, 2 and 3.

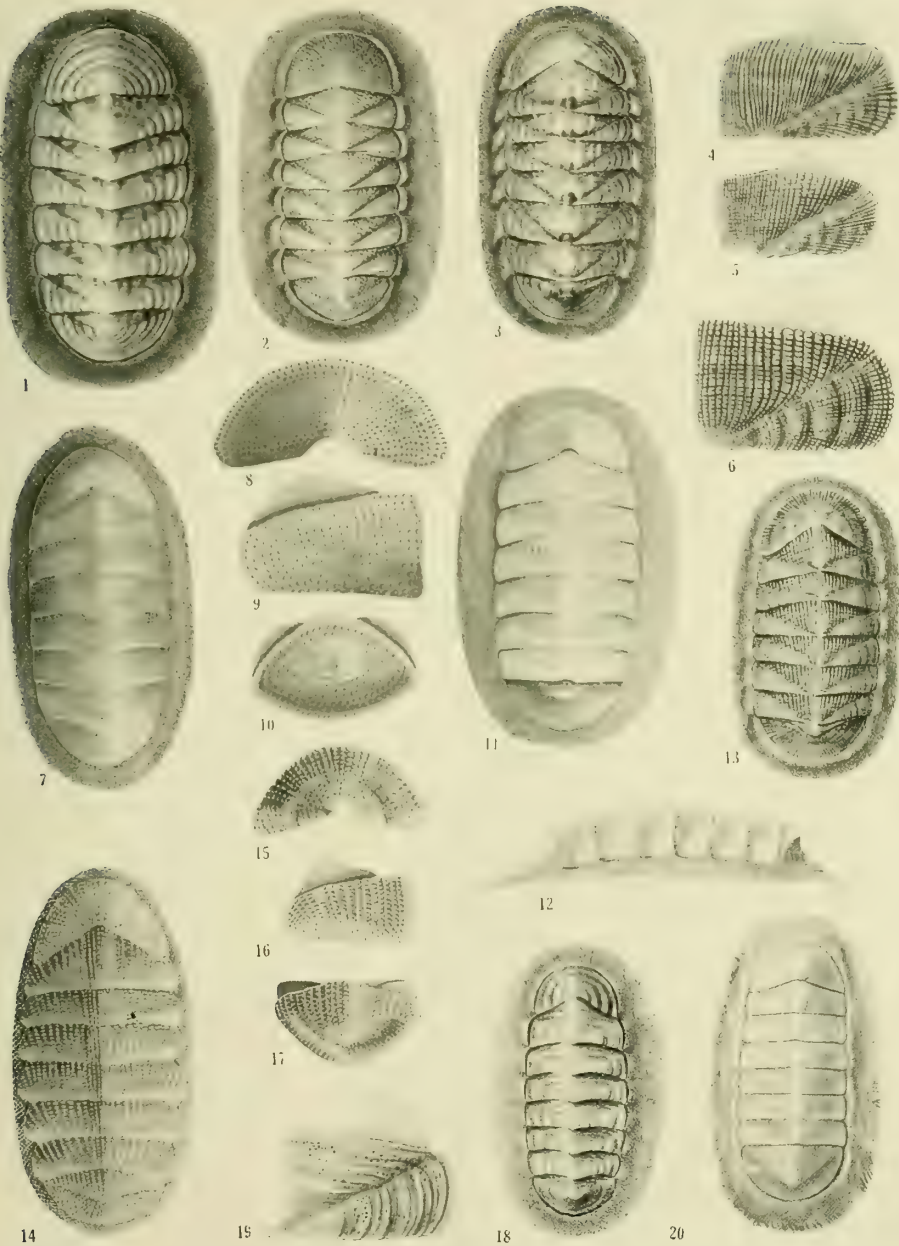


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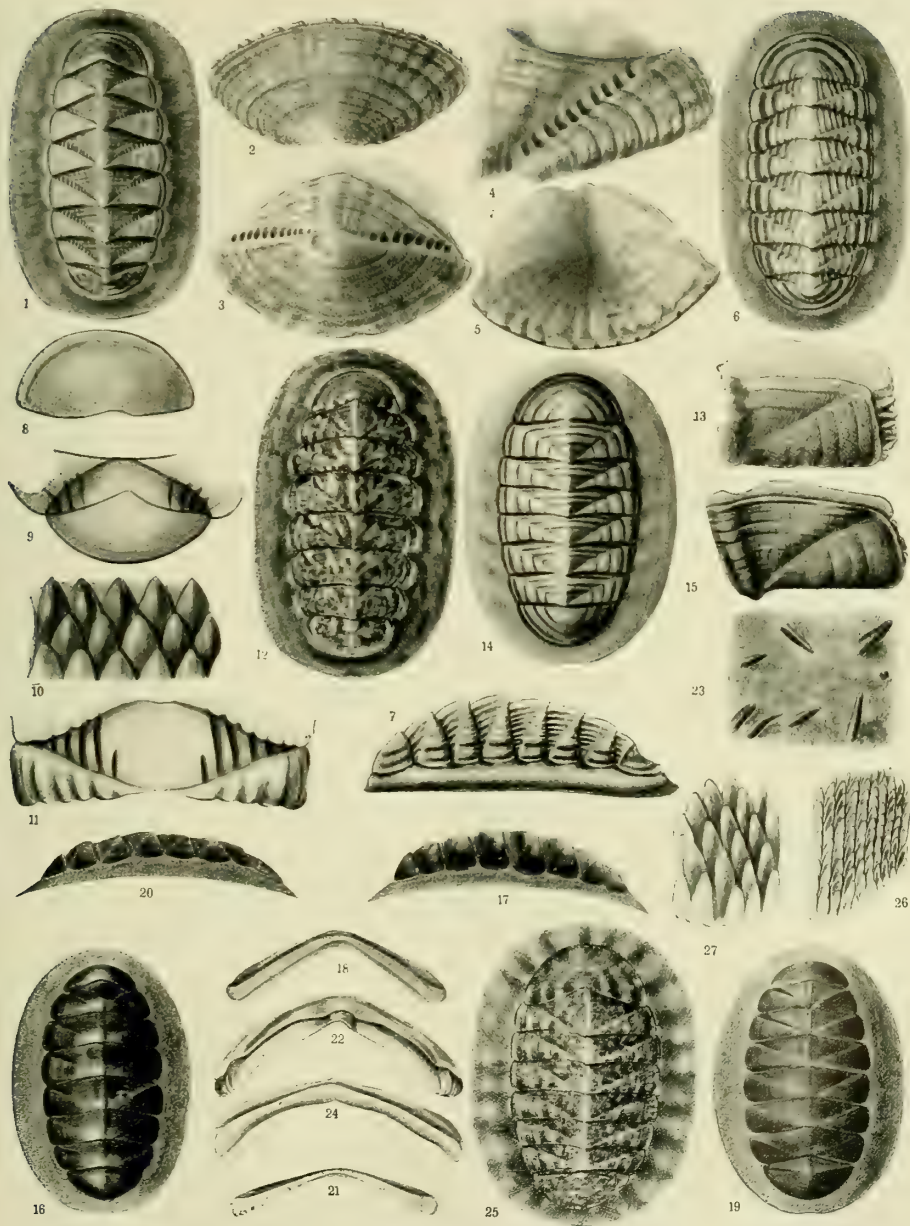




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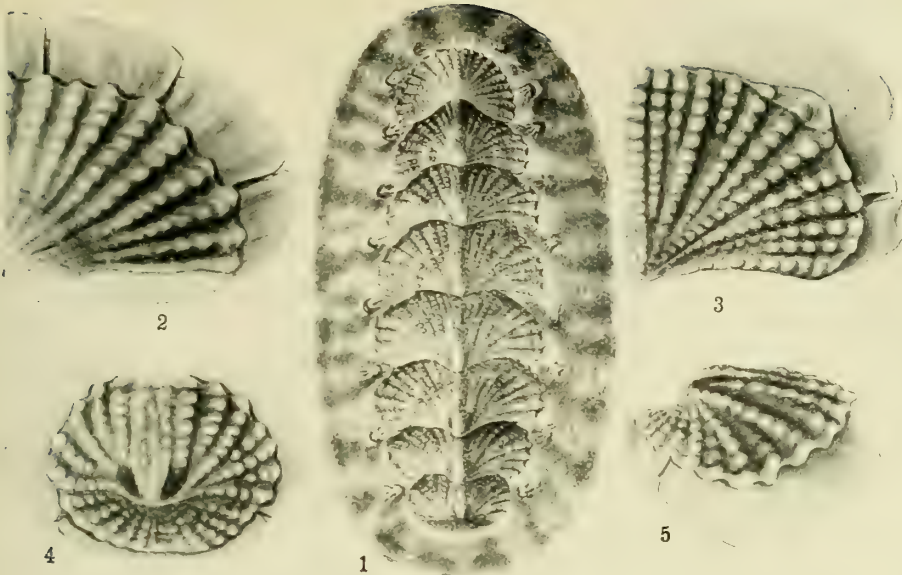






NEOZELANIC LORICATES.





ACANTHOCHITON PELICANENSIS.

Joyce K. Allan, del.



CRAB-EATING SEAL, *Lobodon carcinophaga*.

Photograph by courtesy of "The Daily Guardian."





# THE AUSTRALIAN ZOOLOGIST

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## THE OPOSSUM MOUSE.

*(Dromicia nana.)*

By NORMAN CHAFFER.

(Plate xii.)

On the 7th July, 1929, while searching for honeyeaters' nests in an area of heath land in French's Forest, near Sydney, I came upon an old nest of the yellow-winged honeyeater (*Meliornis novae-hollandiae*) in which the lining appeared to be very much disturbed. Upon investigating I was greatly surprised when a mouse jumped out. It had burrowed beneath and was completely covered by the lining of the nest, the soft velvety material from the banksia cones. I dropped down among the bushes and by a lucky chance managed to get my hand on the small mammal. The surrounding vegetation consisted of banksias, dwarf angophoras, grevillea, stunted eucalypts and numerous small flowering shrubs.

It was a charming little creature, and I was immediately struck by its similarity in general appearance to the ring-tailed opossum in miniature, it having the prominent eyes, rounded ears (though these were larger in proportion than the ring-tail's) and the long prehensile tail bare of hair on the under surface. The tail was often carried coiled up in a spiral, after the manner of the ring-tail. The fur was fine and fluffy and of a soft grey colour, lighter on the under surface of the body. It fastened its teeth on my finger or anything within reach, but its bite was not painful. A faint squeak was occasionally uttered. The length of the body was about three inches, and the tail slightly longer. Upon inquiry it proved to be the opossum mouse or dormouse phalanger.

Taking it into an open space I photographed it on a banksia cone, after patiently replacing it in position many times before it remained still enough. In one photograph the tip of the prehensile tail can be clearly seen hooked on to the cone. Its movements were not particularly lively, but by no means slow. Afterwards it escaped, when I attempted to photograph it in the honeyeater's nest. While in sight it kept to the branches of the shrubs, along which it ran with agility.

I looked up some information on the little marsupial. It ranges from the neighbourhood of Sydney along the east of Australia into Tasmania, and is rather rare. Another species, *Dromicia concinna*, ranges from Adelaide to Swan River, W.A. Three members of a closely allied genus *Eudromicia* are found, one in New Guinea, another on the Atherton Tableland, Queensland, and a third in Tasmania.

The opossum mouse is nocturnal in habit, sleeping during the day, but becoming alert and active at night, running and jumping about the branches, assisted considerably by its prehensile tail. Its food consists of insects, nectar and probably tender buds and flowers. A nest of soft bark is usually constructed in a hollow limb or crevice in a tree. It hibernates during portion of the winter, a fact which is considered to be unique among Australian mammals. During the spring and summer it is rather slender in build, but towards winter becomes much fatter, the tail in particular becoming greatly enlarged. During the dormant period it lives on the fat stored up in the tail. The individual caught by myself must have re-awakened from its hibernation, for it was by no means dormant and of moderately slender proportions.

## OCCASIONAL NOTES.

By A. S. LE SOUEF, C.M.Z.S.

## 1. SOME RARE AUSTRALIAN AND NEW GUINEA MAMMALS WITH NOTES ON THEIR HABITS.

Dorians Tree Kangaroo *Dendrolagus dorianus* Ramsay, Proc. Linn. Soc. N.S.W., viii., 1883, 17.

This very distinct species of tree kangaroo was described by the late Dr. Ramsay, in 1883, from the only two specimens so far recorded. They came from Mount Astrolabe, South East New Guinea. Prospectors in the Edie Creek gold fields have reported this animal in the upper mountains of that district. Mr. MacKreth obtained one, from whom I secured the skin for identification. It is very dark brown in colour, being of a darker shade than the two in the Macleay Museum. The body is uniformly coloured all over, with the exception of a yellow patch on the upper base of the tail. The captor states that "when on the ground the animal appears more or less helpless, and an easy prey. Also, it appears very slow in climbing trees."

White-tailed Rabbit Bandicoot *Thalacomys leucurus* Thomas, Ann. Mag. Nat. Hist. (5), xix., 1887, 397.

The rabbit bandicoots, perhaps the most beautiful and highly specialised of our marsupials, can be divided into two types. Four closely allied species have the tail black and white, while in one species this appendage is wholly white. The latter was described from a single specimen, from an unknown locality in 1887, and up to quite recently nothing seems to have been seen or heard of it. One was procured, however, on an expedition undertaken by the late Dr. George Horn to Lake Eyre in 1924. This is now in the National Museum, Melbourne. It is true to type, and enables a definite locality to be fixed for this rare species.

Ingram's Phascogale *Planigale ingrami* Thomas, Proc. Zool. Soc., li., 1906, 281; Rec. Aust. Mus., xvi., 541.

Amongst the smallest mammals in Australia are certain marsupial mice of the genus *Planigale*. They have been recorded from Northern Australia and north-eastern New South Wales, and probably have a wide range over the northern half of the continent. Mr. Albert De Lestang found this species near Burketown, North Queensland, and has given the following information regarding their habits:—

"They live chiefly in tussocky grass, in dry swamps, and along the perennial streams flowing out of the coastal ranges westwards from Burketown; going seldom, if ever, out of cover, and making no hole in the ground. Their food is chiefly crickets, which shelter under these tussocks in thousands. The males are very active, run rapidly when taken out of cover, and are apparently more numerous than the does. The latter are timid fluffy things, feeding in one's hand readily. They are slow runners when they have young in the pouch, being often totally incapacitated, with the enormous load of youngsters that these tiny mothers have to carry. The number of young varies from four to six."



## 2. ALTERATION IN CHARACTER OF WALLABIES ACCLIMATISED ON KAWAU ISLAND, NEW ZEALAND.

It is interesting to note that acclimatisation of certain Australian animals in New Zealand causes an alteration in the character of the fur. Three species of wallabies and one opossum have been found to vary in the same way, in that the fur is longer, more silky and less dense. One has no difficulty in distinguishing New Zealand opossum pelts from among thousands that may be offered in a sale room.

About the year 1870 the late Sir George Grey introduced several species of wallabies from Australia to Kawau Island, near Auckland. In the intervening sixty years three species from the mainland have shown some alteration, while one kind from Kangaroo Island does not show any difference from the normal type.

Swamp Wallaby, *Wallabia ualabatus* Lesson and Garnier.

Two specimens from Kawau are of the sub-species *apicalis* type. Compared with skins from Australia, the fur is longer and softer, with the overlay of black hairs on the back more marked. These long black hairs, which may reach a length of 45 mm., produce a somewhat mottled appearance.

Black-striped Wallaby, *Wallabia dorsalis* Gray.

Two skins from Kawau are much darker than normal. The hair is longer and finer in character, with the overlay of black hairs more pronounced. The black dorsal stripe is not so marked as is usually the case.

Dama Wallaby, *Thylogale eugenii* Peron and Lesueur.

This species, which inhabits the southern coast of Australia, does not show any alteration from the normal type.

Black-tailed Rock Wallaby, *Petrogale penicillata* Gray.

Compared with specimens from Australia two skins from Kawau have the fur darker and more silky, and all markings much more contrasted. The colouring on the buttocks, being bright foxy-red, is much brighter than is usually the case.

## AVIAN SEA-TOLL.

By TOM IREDALE.

(Plate xiii.)

The toll of seabirds killed by natural causes must be enormous, but not sufficient data has yet been accumulated to suggest even the numbers killed in any one locality each year. As an incentive to other workers, who may achieve extraordinary results, this note has been prepared embodying a few years' desultory observation with a detailed account of one week's toll on a couple of Sydney beaches.

Each year, about the middle of October, many birds are washed up on the beaches of New South Wales, and these have been noted by many, but little has been published on the subject. It is no use at this time to recall past years' occurrences, as no special attempt was made to determine the species, and the present record, it is hoped, will incite some one to watch out in the future, and thus accurate data may be forthcoming for later collation and interpretation.

Nearly all the birds that are washed up on the beaches belong to the Order PROCELLARIÆ or TUBINARÆ, characterised by having tubular nostrils, generally placed on the top of the bill towards its base, but in the larger forms (Albatrosses) on each side. The vernacular "Petrels" is more commonly restricted to the Storm-Petrels, the larger forms being known as Mutton Birds, no other differentiation being popularly used save that the Albatrosses are sometimes called Mollymawks. Technically the latter name is restricted to the smaller Albatrosses which differ at sight on the wing and also technically in their bill formation.

Most of the birds met with on the shore are the wholly dark coloured Shearwaters, vernacularly known as Mutton Birds here and in New Zealand. The Australian Mutton Bird breeds, as is well known, in the Bass Strait Islands, and is a different species from the New Zealand Mutton Bird, while still a third very similar looking bird breeds on the New South Wales coastal islands, but not in the enormous numbers that have so often been written about in connection with the two former birds. Hundreds of Australian Mutton Birds are thrown up along the New South Wales coast during October of each year. These may easily be recognised by the short bill and tail and wholly dark plumage, the large webbed feet being leaden grey in colour with the edge pale fleshy white; the inside of the wing shows uniformly brown. The other Australian bird which is very much scarcer can be at once distinguished by its long tail and its pale fleshy feet; the bill is leaden and similar in shape and length. A bird I have not yet seen on these beaches, but which probably occurs, has also fleshy feet, a medium tail, but has a larger thick flesh coloured bill. Barnes, of the Australian Museum, about whom more hereafter, tells me that some years ago this bird came up in numbers, and this report need not be doubted, but specimens are now desired. Associated with these Australian Mutton Birds, but much more rarely, occurs the New Zealand Mutton Bird; it is a much heavier bird, with a short tail, a longer bill and the winglining is ashy-white streaked with brown; the legs are dark coloured. These four birds need careful examination to separate them, but after criticising a few they can be distinguished with ease. Any other bird met with will be recognised as different yards away, and everyone will be worth picking up. One other Shearwater, as these Mutton Birds are elsewhere called, may be picked up, but it is so different that no confusion is possible; it is much smaller with a very long thin bill, a very short tail, a very dark back, and pure white underparts. If such birds are seen they deserve collection, as there are two similar birds of which only one has been picked up, although

the other may occur; this one has a shorter bill and is slightly smaller, but it would be best to submit all specimens to an expert.

Sometimes many little Petrels, blue-grey above, white below, are washed up, and these occurrences should be reported immediately to the Australian Museum, as some four species, superficially very alike, may be mixed. At sea these are known as Whale Birds or Ice Birds, but here are known as Prions.

I have been searching the beaches for the past half dozen years and recently had the pleasure of making two good finds, as recorded under the title, "The Bird of Providence," in this Journal (Vol. v., 1929, 358). Interested in the osteology of these, I have also picked up skeletons, and my colleague, Mr. G. P. Whitley, has greatly assisted me in this matter. Some time ago he brought me in a skull and sternum, which belonged, according to all the published data to *Thalassoica antarctica*, the Antarctic Petrel, a bird not previously known from the New South Wales coast, and which is not yet unquestionably admissible to the Australian List.

However, on October 13, 1929, Mr. Whitley brought me in half a dozen fresh Mutton Birds and one of the small white-breasted Shearwater which he had collected the previous day on Maroubra Beach, many of the Mutton Birds lying about quite fresh. All these belonged to the Australian species. Upon receipt of these at the Museum it was considered worth while sending W. Barnes, who has had much experience searching the beaches, to Maroubra the next day to search carefully for any strangers. Barnes came in with a small White-breasted Storm-Petrel (*Pelagodroma marina*) and a Wilson's Petrel (*Oceanites oceanica*).

I determined to look along the Manly Beach on my way home, as the weather had been unpropitious in the mornings, and found about thirty Australian Mutton Birds, of which three were the long-tailed species, and one stranger, another specimen of the so-called Bird of Providence. Upon arriving home with my prize I was astonished to find that a neighbour, Mr. Cheeseman, whom I had asked to look out for strange birds on the beaches, had brought in a very fine Shy Albatross which he had picked up on the Freshwater Beach. The next day Barnes went to the Cronulla Beach and from some hundred or so of Australian Mutton Birds sorted out two or three New Zealand Mutton Birds, another so-called Bird of Providence and a strange Prion with a bill agreeing better with that of a Kerguelen form than with any of the Neozelanic or Australian birds. I went along the Freshwater Beach the next morning and counted a dozen Australian Mutton Birds, and one of the small white-breasted Shearwaters. No fresh birds were coming up, and the wave seemed to have expended itself between the 12th and 14th of the month. On the 19th I went to Narrabeen and walked down the beach from the lagoon entrance to Dee Why, some 3-4 miles only. Many birds had been cast up early in the week and were all well fly-blown, but easily recognisable, though not preservable. I examined and recorded each one, with the result that one hundred and forty was the total. Of this total no less than one hundred and twenty-three were short tailed Australian Mutton Birds (the Bass Strait bird), the remaining seventeen being referable to five species as follows: Five the long-tailed Australian Mutton Bird, five New Zealand Mutton Birds, five Prions, of two species, and two small White-breasted Shearwaters.

In order that this note may be of service to others in searching the beaches for birds, I herewith give details for the determination of the species mentioned:—

1. Australian Mutton Bird (*Neonectris tenuirostris* of Mathews and Iredale; *Puffinus* (*Neonectris*) *tenuirostris* of Official Check List, 2nd ed.)

The general coloration is sooty, with a more or less brownish tinge; freshly moulted birds show very little brown and worn specimens are distinctly brownish; generally the under surface is paler and more brownish than the upper and the throat more pallid, in some cases distinctly whitish; the under part of the wings should show uniformly brown-grey; the bill is dark, lead or slate colour, while the legs are also leaden, the outer edge of the leg and the outer toe much paler. The bill from the feathering to the tip is about one inch and a quarter, while the leg is about two inches; the wing from the carpal joint to the tip of the longest feather is just about eleven inches.

There is little variation, the bill sometimes a little stouter, and among the hundred odd birds examined on the Narrabeen to Dee Why trip only two were aberrant, both being young birds with undersized bills and whitish feathers to the wing lining; one of these provided the solution of this puzzle, as looking at it lying breast up for a while wondering why the wing lining was whitish, a tail feather was seen to have a whitish tip; the wings were then stretched out and similar white tips and blotches were seen on the primaries. It was then rolled over, when a beautiful sight was presented; it was strikingly blotched with white and would have made a beautiful photograph, but unfortunately I had no camera. It was too far decomposed to permit of any attempt at preservation, the feathers coming out with the least touch. Closer examination showed that the new feathers were coming in properly coloured so that this partial albino weakling, had it survived the storm, would have appeared as a normal bird after its moult. While this bird appeared to have been moulting feather by feather, I picked up a bird a few years ago which had all the primaries in moult simultaneously after the style of the ducks.

2. Australian Mutton Bird with long tail (*Thyellodroma pacifica* of Mathews and Iredale; *Puffinus (Thyellodroma) pacificus* of Official Check List, 2nd ed.) Wedge-tailed Shearwater of technical writers.

Very like the preceding in general appearance, but a little browner throughout; dead on the beach, the very pale, almost white legs, attract attention and then the longer tail is easily seen; the inside of the wing is unicolour, with the rest of the under surface brown; the bill is brownish slate, drying to a brown, and the legs, as above stated, are notably light. The bill is a little longer, nearly an inch and a half long, while the legs and wing are about the same length as in the preceding bird, but the tail, measured from the roots of the feathers, is about five and a half inches, while the short-tailed species has only a little over three inches of tail. Lying on the beach, the wings extend beyond the tail in the latter case and do not reach to the end of the tail in this bird.

Breeding close in along this coast this species does not come to harm so easily, and it is well to look out for the Norfolk Island or Kermadec Island breeding forms, as they may occur sometime. These are much larger birds, with longer wings and longer, more massive bill, nearly two inches long, and the birds are generally very dark in colour.

3. New Zealand Mutton Bird (*Neonectris griseus* of Mathews and Iredale, and *Puffinus (Neonectris) griseus* of the Official Check List, 2nd edition).

Very easily confused with the Australian Mutton Bird with the short tail, but has the inside of the wings ashy-grey, instead of sooty brown; the under surface is perhaps more greyish, but the bill and legs are both dark. The bill is a little longer and generally stouter, and the legs are slightly longer.

In the flesh there is a great difference in weight, a dead New Zealand



bird weighing 24 oz., while the Australian only weighed 16 oz. However, the skeletal features show that they are less closely related than the superficially suggests, and they should not be referred to the same sub-genus as has been done, but the present species should be provided with a sub-genus (*Paranectris*) for itself. I hope to give figures of all the skulls of these species later.

4. Fleishy footed Shearwater (*Hemipuffinus carneipes* of Mathews and Iredale; *Puffinus* (*Hemipuffinus*) *carneipes* of Official Check List, 2nd edition).

I have not yet met with this bird, but Barnes, who knows it well, states it has occurred commonly in years past. In order to stimulate search for this I am here giving notes for its identification:—

Of similar coloration to the preceding three, it is a heavier, bigger bird, with a large pale bill and large pale feet; the inside of the wing is brown like the under surface. The bill is more than an inch and a half long, the wing is more than twelve inches long and the legs are more than two inches long; the tail is medium, about four inches long.

A guide to these birds may be drawn up thus:—

All uniformly slaty or sooty brown.

1. Tail short, wing lining brown, bill short, legs dark. . . . . Australian Mutton Bird, *Neonectris tenuirostris*.
  2. Tail short, wing lining ashy-grey, bill long, legs dark. . . . . New Zealand Mutton Bird, *Neonectris griseus*.
  3. Tail long, legs very pale, bill weak and dark. . . . . Wedge-tailed Shearwater, *Thyellodroma pacifica*.
  4. Tail medium, legs very pale, bill strong and pale. . . . . Fleishy-footed Shearwater, *Hemipuffinus carneipes*.
- And:—
5. Tail medium, legs dark, bill very strong and black. . . . . "The Bird of Providence," *Pterodroma melanopus*.
  6. Tail medium, legs dark, bill very strong and pale. . . . . Black Petrel, *Procellaria parkinsoni*.

The two lastmentioned birds had better be introduced here, as their coloration is like that of the Mutton Birds, but while they are called by that name in some places, they belong to very different series.

5. Though superficially comparable, the thick black bill and black legs separate the Bird of Providence at sight. However, though I recorded all we knew about the Bird of Providence (Aust. Zool., v., 1929, 358) there is still a mystery in connection with the birds found recently on this coast. Upon careful comparison the freckling on the face is not so well defined as on the Lord Howe Island specimens, nor is the colour of the back so grey; it is more brownish and at the present time it is just possible that the so-called Birds of Providence found here may not breed on Lord Howe Island, but may come from some other place. Hence it is very necessary that any specimens met with should be sent immediately to the Australian Museum, so that this puzzle may be cleared up.

6. Another very similar bird, almost wholly black with black legs and a very stout bill which instead of being black is very pale horn coloured. This bird breeds in New Zealand, where in the North Island it is also called Mutton Bird, and has once been picked up on a New South Wales beach fifty years ago, but it may recur any time and should be looked for amongst the hundreds of Australian Mutton Birds. Every other seabird met with on the beaches should be picked up, save perhaps the common Sea Gull.

7. To return to the Petrels, the white-breasted little Shearwater (*Reinholdia reinholdi* of Mathews and Iredale, *Puffinus (Reinholdia) gavia* of the Official Check List, 2nd edition) is separated from all the preceding by its smaller size and white under surface. However, it was confused for many years in Australian literature with a slightly smaller bird with a shorter bill, and of which there is at present no proof of the occurrence, though very probably it will be met with. The present species has a long thin bill and a very short tail, the bill nearly an inch and a half long, the tail less than three inches and the wing only about eight inches. The one to be looked for yet is the Allied Shearwater (*Puffinus assimilis* of Mathews and Iredale, and also of the Official Check List, 2nd edition) which breeds on Lord Howe, Norfolk and the Kermadec Islands, as well as New Zealand. This bird has the bill just about one inch long, the tail about the same size as the other, and the wing very little more than seven inches. The coloration above of both birds is bluish-black, the latter bird paler and always bluish, whereas the former one wears to a brownish-black.

There are other birds that may occur which are superficially similar, but at once separable by their stout black bills and black legs. Every one should be picked up for identification.

Many very small bluish birds with the under surface white occur in huge flocks in the open sea, and sometimes the wind changes and drives a flock on shore. Generally the members of a flock belong to the same species, but when birds get lost at sea they link up with the nearest flock, and hence whenever there is a large number cast up on the beaches there are one or two strangers included. The only notable difference in these species is in the breadth of the bill, some having very narrow, others very broad bills. As all need careful comparison, the Australian Museum should be notified immediately if any series of these birds are seen on the beaches.

Still smaller, not much larger than sparrows, are the Storm-Petrels, which may rarely occur. One, the only common one, is pale-grey above with the under surface white; others are dusky black, sometimes with the rump white, sometimes with the abdomen white, sometimes with the abdomen white with a dark line down it, and the throat white. These may occur, but on account of their small size be overlooked. A very beautiful little form, sometimes called the Fairy Petrel, breeds in the Islands of Bass Strait, but may be found on the beaches, though I have not yet met with it. This bird is sooty brown above with the rump grey, and white underneath with the throat brown. It is not necessary to go into further detail regarding these birds, as all are very rare, and if observed should be picked up and sent to the Museum. It is probable that other forms may be found.

Just a few words about Albatrosses and Mollmawks. These fine fliers do not often come to grief, but if any should be met with within reasonable distance of the Museum it should be either carried in or the authorities notified. If beyond such a distance the head should be cut off and sent or brought in. It is very fortunate that every Albatross and Mollmawk shows distinctive and readily identifiable features in the bill alone. Recently two or three Mollmawks have been found, and apparently each belongs to the Neozelanic race of the Shy Albatross, so that if others were discovered they might equally be strangers to this coast.

Mr. H. Grant, of the Australian Museum, has just reported that many dead Mutton Birds beyond the state of preservation were noted on Palm Beach, north of Sydney, on November 16. He examined a number and found at least half a dozen belonged to the thick billed form of *griseus*, but no thin billed ones, the remainder being the Australian *tenuirostris*.

ADDITIONS TO THE CHECK-LIST OF THE FISHES OF  
NEW SOUTH WALES.

(No. 3.)

By GILBERT P. WHITLEY,

Ichthyologist, Australian Museum.

(By Permission of the Trustees of the Australian Museum.)

(Plate xiv.)

The present paper is a continuation of my last list of additions, which appeared in "The Australian Zoologist," v., 4, 1929, 353-357.

Most of the species added to the New South Wales fish-fauna in recent years have been caught in fairly deep water over the continental shelf. The continued interest of many friends aboard the trawlers and their help in securing specimens for the Australian Museum has been indispensable, and I desire especially to thank Mr. Alec Ward and Captain Knud Møller of the trawlers and Captain L. Comtesse of the dredge "Triton" for the fishes they have submitted to me from time to time. Of the pelagic fishes of the open Pacific and the fishes of the great depths off our coasts, little is as yet known but many new records will, it is hoped, be forthcoming when the fishes of the "Dana" expedition are finally determined.

Family MACRORAMPHOSIDAE.

MACRORAMPHOSUS MOLLERI, *sp. nov.*

*Centriscus gracilis* Pedley, Proc. Linn. Soc. N.S. Wales, ix., 1884, 119 (Port Jackson, N.S. Wales). Not *Centriscus gracilis* Lowe, Proc. Zool. Soc., Lond., vii., October, 1839, 86, from Madeira.

*Centriscus gracilis* var. *japonicus* Ogilby, Cat. Fish. N.S. Wales, 1886, 42 (Port Jackson). Not *Centriscus japonicus* Günther, Cat. Fish. Brit. Mus., iii., 1861, 522, from Japan.

*Macroramphosus gracilis* Waite, Austr. Mus. Mem. iv., 1., December 23, 1899, 61, pl. vii., fig. 2 (Maroubra, N.S. Wales). *Id.* Waite, Rec. Austr. Mus., iii., 1900, 199 (Lord Howe Island).

*Macroramphosus japonicus* ? Regan, Ann. Mag. Nat. Hist. (8), xiii., January, 1914, 19 (N.S. Wales reference only).

*Macroramphosus gracilis* McCulloch, Austr. Mus. Mem., v., 1., 1929, 83.

The Little Bellows Fish of New South Wales which has been called *Macroramphosus gracilis* by authors is apparently distinct from *Centriscus gracilis* Lowe. The second dorsal spine has few serrations, originates before the vertical from the vent, and, in most specimens when depressed, reaches the second dorsal fin. Nine to twelve dorsal rays, eighteen to nineteen anal; depth, 5—5½ in total length. The New South Wales form, which I name *M. molleri*, is allied to *Centriscus japonicus* Günther, but Regan, who compared Günther's types with Waite's figure was uncertain as to their identity. The holotype of *M. molleri* is the specimen figured by Waite, which came from Maroubra Beach, near Sydney, New South Wales (Austr. Mus., Regd. No. B. 7163). Captain Knud Møller, of the trawler "Durraween," after whom the species is named, collected a specimen seven miles off Two-fold Bay, New South Wales, in or over 45 fathoms of water. It has been suggested that the species is pelagic, so that specimens could enter a trawl as it was being hauled through the upper layers of the sea.

## NOTOPOGON LILLIEI Regan.

*Centriscoops humerosus* McCulloch, Zool. Res. Endeavour, i., December 22, 1911, 24, pl. v., and text-fig. 9. Sixty miles south of Cape Everard, Victoria; 60-70 fathoms (IA. 1364). Not *Centriscoops humerosus* Richardson, 1846, from South Australia.

*Notopogon lilliei* Regan, Ann. Mag. Nat. Hist. (8), xiii., January 1, 1914, 14. New Zealand. *Idem. ibid.*, 18 and 20 (Southern Australia and New Zealand).

*Centriscoops cristatus* McCulloch, Biol. Res. Endeavour, ii., July 3, 1914, 93. New name, inadvertently introduced, equivalent to *Notopogon lilliei* Regan. New Zealand.

Two specimens trawled in 75 fathoms, 10 miles W.N.W. from Gabo Island, by Captain Moller, cause this species to be added to the New South Wales list.

## Family MACROURIDAE.

## PARAMACRURUS AUSTRALIS (Richardson).

*Lepidoleprus australis* Richardson, Proc. Zool. Soc. Lond., vii., November, 1839, 100. Port Arthur, Tasmania. Type in British Museum.

*Coelorhynchus mortoni* Ogilby, Pap. Proc. Roy. Soc. Tasm., 1896 (1897), 83. Derwent Estuary, Tasmania. Type destroyed.

*Coelorhynchus (Paramacurus) australis* McCulloch, Biol. Res. Endeavour, v., 4, 1926, 177.

*Paramacurus australis* Whitley, Pap. Proc. Roy. Soc. Tasm., 1928 (1929), 49.

Mr. Alec Ward obtained several examples of this species in deep water, south of Montague Island, in August and September, 1929. The largest is a female, 22 inches long, a record size. Austr. Mus., Nos. IA. 4008 and 4010. New record for New South Wales.

## Family PLECTORHINCHIDAE.

## PLECTORHINCHUS ROUGHLEYI, sp. nov.

*Plectorhynchus reticulatus* McCulloch, Biol. Res. Endeavour, iv., 4, October 31, 1916, 185, pl. liii. New South Wales. *Idem.* Ogilby, Mem. Q'ld. Mus., vi., 1918, 100 (Moreton Bay). *Id.* Partridge and Whitley, Mem. Q'ld. Mus., ix., 1927, 87 (Pellw Islands, North Australia). Not *Diagramma reticulatum* Günther, Cat. Fish. Brit. Mus., i., 1859, 334, from China.

*Plectorhynchus reticulatus* McCulloch, Austr. Zool., ii., 2, 1921, 57, and Austr. Mus. Mem., v., 1929, 217.

*Diagramma amabile* and *D. amicum* Saville-Kent, Great Barrier Reef, Austr., 1893, 369. *Nomina nuda*. Queensland.

The New South Wales specimen described by McCulloch appears to differ from the true *P. reticulatus* (Günther) in having 11 lat. 55 instead of 85, 10 rows of scales between 1 lat. and back instead of 13, second anal spine longer than third, diameter of eye sub-equal to snout, more anterior termination of dorsal fin, with shorter caudal peduncle and caudal fin. McCulloch's specimen was secured in the Sydney Fish Markets, and probably originally came from northern New South Wales. It may be regarded as the holotype of a new species, in view of the differences mentioned above, and I have pleasure in naming it *Plectorhynchus roughleyi* after my friend, Mr. Theodore Cleveland Roughley, of the Technological Museum, Sydney, author of "Fishes of Australia and Their Technology."



## Family EPINEPHELIDAE.

## Genus EPINEPHELUS Bloch.

- Epinephelus* Bloch, Nat. aul. Fische, vii., 1793, 11 (*vide* Sherborn, Index Anim., i., 1902, 330). Logotype, *E. marginalis* Bloch, by opinion (Smithson. Misc. Coll., lxxiii., 4, 1926, 7, opin., 93). Not *Epinephela* Hübner, 1818, a genus of *Lepidoptera* (NYMPHALIDAE).  
*Schistorus* Gill, Proc. Acad. Sci. Philad., 1862, 236 and 237. Haplotype, *Serranus mystacinus* Poey.

EPINEPHELUS (SCHISTORUS) ERGASTULARIUS, *sp. nov.*

(Plate xiv., fig. 1.)

- Plectropoma susuki* Günther, Proc. Zool. Soc. Lond., 1867, 100. Sydney.  
*Idem.* Ogilby, Cat. Fish. N.S. Wales, 1886, 9. Not *P. susuki* Cuv. and Val., 1828.

- Epinephelus septemfasciatus* Boulenger, Cat. Perc. Fish. Brit. Mus., 1895, 169 and 226 (Port Jackson specimen only). *Idem.* Waite, Austr. Mus. Mem., iv., 1, 1899, 75 (Shoalhaven Bight). *Idem.* McCulloch, Zool. Res. Endeavour, i., 1911, 49; Austr. Zoologist, ii., 2, 1921, 46; Check-list Fish. N.S. Wales, 1922, 46; Austr. Mus. Mem., v., 2, 1929, 146. Not *Perca septemfasciata* Thunberg, 1793.

- Epinephelus (Schistorus) septemfasciatus* Jordan and Richardson, Proc. U.S. Nat. Mus., xxxvii., 1910, 445 and 458 (Australian references only).  
 Br. 5. D.xi./14; A.iii./10 (9); P.17, V.i./5; C.13.

Head (75 mm.) 2.4 in length to hypural joint (180). Depth (67) 2.6 in same. Pectoral (40) 1.6, height of soft dorsal (28) 2.7, depth of caudal peduncle (23) 3.2 and width at opercles (31) 2.4 in head. Sub-orbital (7) 2 in eye (14). Inter-orbital width (16) equal to snout (16).

Head large, compressed, longer than high, and covered with small scales, excepting before the eyes and on the mouth, chin and inter-orbital. Nostrils anterior to the eyes, the posterior much larger than the anterior. Mouth large, maxillary broad, reaching to below posterior half of eye, naked, and with a supplemental bone. A strip of small, sharp, curved teeth in each jaw, those of the mandible in two main series on each side. A pair of small anterior canines in each jaw. A broad, V-shaped patch of teeth on vomer, and a narrow band on each palatine. Tongue lanceolate, toothless. Preopercular margin serrated, with about nine stronger serrations at the angle. Three opercular spines, the median one largest and situated nearer the lowest spine than the highest. Border of opercular flap curved convexly above, concavely below.

Body compressed, covered with small ctenoid scales, which extend on to the basal halves of the fins. Lateral line sub-parallel to the curve of the back and extending along the tail.

Dorsal originating slightly behind the vertical of the origins of the paired fins and terminating behind the anal. Third to sixth dorsal spines longest, sub-equal. Margins of soft fins rounded.

General colour greyish, crossed by seven transverse dark brown bands of sub-equal width; the anterior bands are more oblique than the posterior and there is an incipient eighth band on the nape. The unpaired fins are brownish, slightly lighter inframarginally. Ventrals dark brown. Pectorals light. A very dark brown saddle-shaped mark on the upper half only of the caudal peduncle. Head brown, with an oblique dark brown mark along the edge of the maxillary groove, and a dusky tinge on the opercular flap.

Described from the holotype of *Epinephelus ergastularius*, a specimen 180 mm. in standard length or nearly 9½ inches in total length. Australian Museum, Registered No. 1A. 2482.

*Type locality*: Off Long Bay, coast near Sydney, New South Wales; caught on hook and line in July, 1925, by Mr. G. Wakeford, in about fifty feet of water, over a sandy bottom.

Other specimens are in the Australian Museum from the following localities in New South Wales: Shoalhaven Bight; about 15 fathoms ("Thetis"). Off Wooded Bluff, Clarence River; 26-30 fathoms ("Endeavour"). Between Port Hacking and Wollongong; 50-70 fathoms, July 28, 1915 (A. R. McCulloch). Off Long Bay, August 18, 1929 (S. Silk). My friend, Mr. F. A. McNeill, has been instrumental in getting me both Long Bay specimens, and I have much pleasure in recording my indebtedness to him for them. This species apparently lives in the sub-littoral zone below the lowest tide-marks, and in water either too rocky or not deep enough for commercial trawling purposes, and, like all the animals of that area, is difficult to secure, and is accordingly popularly regarded as rare.

*Affinities*: *Epinephelus ergastularius* is apparently closely allied to the Japanese *Perca septemfasciata* Thunberg (1), of which *Plectropoma susuki* Cuvier and Valenciennes (2), and *Serranus octocinctus* Temminck and Schlegel (3) are synonyms. It appears to differ, however, in having more anal rays, anterior transverse bands broader, and saddle-shaped mark restricted to upper part of caudal peduncle. The lower jaw and the naked maxillary appear to be shorter, and the eye smaller in *E. ergastularius*, when compared with Temminck and Schlegel's figure. The Japanese species has been further described by Steindachner and Döderlein (4), and by Jordan and Richardson (5).

A uniform brownish form of this species, perhaps new, has been recorded from Honolulu by Fowler (6).

#### Family ALUTERIDAE.

#### Genus STEPHANOLEPIS Gill.

*Stephanolepis* Gill, Proc. Acad. Nat. Sci. Philad., 1861, 78. Orthotype, *Monacanthus setifer* Bennett.

#### Sub-genus PERVAGOR, nov.

Orthotype: *Monacanthus alternans* Ogilby.

Head and body covered with spiny scales. No cutaneous filaments. Dorsal spine longer than snout, with two rows of strong spaced barbs posteriorly. None of the fin-rays elongate. Pubic bone ending in a prominent, strongly-barbed pelvic spine, the end of which is movable. Ventral flap a tough membrane, very spinose, not extending beyond pelvic spine. Depth at origin of dorsal and anal fins slightly more than length of head, and more than one-third of the length to the hypural.

- 
1. Thunberg, Vetensk. Akad. Handl. (Stockholm), xiv., 1793, 56, pl. i. Nagasaki, Japan (*vide* Fowler, 1928).
  2. Cuvier and Valenciennes, Hist. Nat. Poiss., ii., October, 1828, 404. Japan.
  3. Temminck and Schlegel, Faun. Japonica, Pisces, 1842, 7, pl. iv.a, fig. 2. Japan.
  4. Steindachner and Döderlein, Denkschr. Akad. Wiss. Wien., xlvii., 1883, 230.
  5. Jordan and Richardson, Proc. U.S. Nat. Mus., xxxvii., 1910, 459.
  6. Fowler, Occas. Papers Bern. P. Bishop Mus., viii., 7, 1923, 379; Mem. Bishop Mus., x., 1928, 180.

## STEPHANOLEPIS (PERVAGOR) ALTERNANS (Ogilby).

(Plate xiv., fig. 2.)

*Monacanthus nitens* Waite, Proc. Linn. Soc. N.S. Wales (2), ix., 2, December 10, 1894, 224. Maroubra, New South Wales. Not *M. nitens* Hollard, 1854. *Id.* Waite, Rept. Trawl. Oper. Thetis, 1898, 64 (Lord Howe Is.). *Id.* Ogilby, Abstr. Proc. Linn. Soc. N.S. Wales, November 30, 1898, iii. *Id.* McCulloch, Austr. Zool., ii., 3, 1922, 125.

*Monacanthus alternans* Ogilby, Proc. Linn. Soc. N.S. Wales, xxiii., 4, May 19, 1899, 741. New name for *M. nitens* Waite (*non* Hollard) from Lord Howe Island and N.S. Wales. Type in Austr. Mus. Type locality, by present designation, Maroubra, New South Wales.

*Stephanolepis nitens* Waite, Mem. N.S. Wales Nat. Club., i., 1904, 55.

D.ii./30; A.26; P.12; C.12.

Head (13 mm.) 2.7 in length to hypural (36). Depth (14) 2.5 in same or 2 in distance from mouth to end of pelvic spine. Dorsal spine (12) subequal to inter-dorsal space (12.5). Eye (4) equal to inter-orbital width (4), less than pectoral (5). Length of caudal peduncle (3) 2 in its depth (6).

Head and body compressed, covered with scales, each of which has a prominent conical spine. No bristles or enlarged spines on caudal peduncle. Origin of soft dorsal in advance of that of anal. Margins of fins gently rounded, the rays spiny on their proximal halves. Pelvic spine with an anterior, a median, and a posterior group, each of about four barbs, and with a spiny anterior surface.

Colour, after long preservation in alcohol, brown on back and posterior half of body, silvery on cheeks, sides, and ventral flap. Fins whitish.

Described and figured from the lectotype of *Monacanthus alternans* Ogilby, which is the identical specimen described by Waite as *M. nitens* in 1894 (Australian Museum, Registered No. IA.4019). This is 1 $\frac{3}{4}$  inches long and agrees fairly well with the original account of *Monacanthus nitens* (Hollard, Ann. Sci. Nat. (4), Zool., ii., 1854, 364, pl. xiv., figs. 12 and 12a) from Tongatabu, but lacks the long spines on the back shown in Hollard's figure. Fowler (Mem. Bish. Mus., x., 1928, 456) regards *M. nitens* as a synonym of *M. melanocephalus* Bleeker (Nat. Tijdschr. Ned. Ind., v., 1853, 95) from Solor, East Indies. I have examined Queensland specimens of the latter species, and find that they are less spiny than *alternans*, and have a black mark around the gill-slits and a chequered caudal, colours which are apparently wanting in both *nitens* and *alternans*.

The only specimen of *Stephanolepis (Pervagor) alternans*, besides the type, which I have seen is unfortunately without locality. It is 55 mm. in total length, the largest known, and has the profile of the head strongly concave, body and head intensely spiny; D.31; A.27. It was presented to the Australian Museum by James Douglas Ogilby in 1901, with a collection of fishes from many seas, and perhaps came from Lord Howe Island (Registered No. I.4969).

*Type locality:* Maroubra Beach, New South Wales; collected by Thomas Whitelegge, in May, 1894. The species has not since been found in New South Wales, so the specimen was perhaps a straggler, brought from warmer waters by the southward-flowing Notonectian current.

Waite recorded that he found a specimen in a rock-pool at Lord Howe Island, but neither his nor Ogilby's specimens from that locality are now to be identified with certainty in the Australian Museum.

## Family GOBIIDAE.

When McCulloch and Ogilby wrote their monumental paper (7) on "Some Australian Fishes of the Family Gobiidae," they realised the necessity for sub-dividing the cumbersome larger genera such as *Gobius*, but did not desire to "create unnecessary additions to the already long list of Gobioid genera." Nevertheless, it seems necessary to propose new generic names for many of the Australian forms, as confusion is only maintained by calling widely different fishes "*Gobius*," when they are obviously not congeneric. Moreover, it appears to be safer to provide new genera for gobies than for many groups of fishes as they are for the most part restricted to shore localities, they have easily distinguished characters, and analysis of the genera that have so far been named shows a paucity of synonyms. As a preliminary, I therefore propose the following new generic names, with their respective genotypes, for some Australian gobies and believe that by adopting this course, future work on the group will be rendered easier. The generic characters are given in McCulloch and Ogilby's key.

**FAVONIGOBIUS**, *nov.* Type, *Gobius lateralis* Macleay, Proc. Linn. Soc. N.S. Wales, v., 1881, 602. King George's Sound, West Australia.

**CHLAMYDOGOBIUS**, *nov.* Type, *Gobius eremius* Zietz, Rept. Horn. Exped., ii., 1896, 180, pl. xvi., fig. 5. Central Australia.

**FUSIGOBIUS**, *nov.* Type, *Gobius neophytus* Günther, Journ. Mus. Godef., iv., 11 (Fische Südsee, v.), 1876, 174, pl. cviii., fig. E. Ponapé, Apia, Huahine, and Tahiti.

**METAGOBIUS**, *nov.* Type, *Eleotris sclateri* Steindachner, Sitzb. Akad. Wiss. Wien., lxxx., 1, 1880, 157. Society Islands.

**PARVIGOBIUS**, *nov.* Type, *Parvigobius immeritus*, new name for *Gobius flavescens* De Vis, Proc. Linn. Soc. N.S. Wales, ix., 1884, 689. Moreton Bay, Queensland. *Id.* McCulloch and Ogilby, Rec. Austr. Mus., xii., 10, 1919, 224, pl. xxxvi., fig. 3 (type). Preoccupied by *Gobius flavescens* Bloch and Schneider, Syst. Ichth., 1801, 73.

**OSTREOGOBIUS**, *nov.* Type, *Gillichthys australis* Ogilby, Proc. Linn. Soc. N.S. Wales (2), ix., 1894, 367. Jervis Bay, New South Wales.

**ARENIGOBIUS**, *nov.* Type, *Gobius bifrenatus* Kner, Voy. Novara, Zool., i., 1865, 177, pl. vii., fig. 3. Sydney, New South Wales.

A new genus of Gobies, collected by the writer at Gundamaian, National Park, New South Wales, may be diagnosed as follows.

*WAITEOPSIS*, *gen. nov.*

Orthotype, *WAITEOPSIS PALUDIS*, *gen. et. sp. nov.* Type (1A.3917) in Australian Museum.

Head depressed, broader than deep. Mouth large, extending backward beyond eye. Tongue not notched. No large canine teeth. Bands of small, simple, curved, close-set, movable teeth in each jaw. Chin and mandible without barbels. Minute papillae in rows on head; no prominent ridges. Cheeks naked; opercles with a few small scales. Top of head and anterior portion of nape naked. Form elongate. Body with fifty or more transverse rows of ctenoid scales. Exposed edge of shoulder girdle smooth.

(7) McCulloch and Ogilby, Rec. Austr. Mus., xii., 10, 1919, 193-291, pls. xxxi.-xxxvii., text-figs. 1-5.



First dorsal with six spines. Soft dorsal and anal separated from caudal. Upper pectoral rays neither free nor silk-like. Ventrals well developed, not cup-shaped and not adnate to belly. Caudal rounded.

A list of the New South Wales Gobies, as given in McCulloch's Check-list and as known under the new names, is set forth hereunder:—

- 307a. *Mugilogobius devisi* McCulloch and Ogilby = *Mugilogobius stigmaticus* (De Vis).
- 308a. *Bathygobius krefftii* (Steindachner).
- 309a. *Gobius australis* = *Ostreogobius australis* (Ogilby).
- 309b. *Gobius lidwilli* = *Berowra lidwilli* (McCulloch).
- 309c. *Gobius bifrenatus* = *Arenigobius bifrenatus* (Kner).
- 309d. *Gobius semifrenatus* = *Arenigobius semifrenatus* (Macleay).
- 309e. *Gobius frenatus* = *Arenigobius frenatus* (Günther).
- 309f. *Gobius lateralis obliquus* = *Favonigobius obliquus* (McCulloch and Ogilby).
- 310a. *Cryptocentrus gobioides* (Ogilby) = *Cryptocentrus cristatus* (Macleay).
- 311a. *Callogobius hasseltii mucosus* = *Callogobius mucosus* (Günther).
- 312a. *Leme purpurascens* De Vis.

To these may be added:—

- 338a. *Gunnamatta insolita* Whitley.
- 393a. *Waiteopsis paludis* Whitley.

I may remark here that *Gobius maculatus* Castelnau (Vict. Offic. Rec. Philad. Exhib., 1875, 20), from Queensland, is apparently a synonym of *G. ornatus* Rüppell. In any case, the name is preoccupied by *G. maculatus* Nardo (Isis, xx., 6, June, 1827, 478.—*vide* Sherborn).

The European gobioid genus, *Eichwaldia* Smitt. (Ofv. Vet. Ak. Forh., 1899, 545—*vide* Jordan, Gen. Fish., iv., 1920, 487) is preoccupied by *Eichwaldia* Billings (Geol. Surv. Canada, Rept. Progr. for 1857, publ. 1858, 190; Canad. Nat. Geol., iii., 1858, 442), a genus of fossil brachiopoda and requires a new name, *Eichwaldiella*.

*Butigobius*, nov. Type, *Lebistes scorpioides* Smitt. Replaces *Lebistes* Smitt. (Ofv. Vet. Ak. Forh., 1899, 543) preoccupied by *Lebistes filippi* (Arch. Zool. Anat. Fisiol., i., 1862, 69; *vide* Jordan, Gen. Fish.).

*Cingulogobius* Herre (Philip. Bur. Sci. Monogr., xxiii., September, 1927, 88 and 201) is an absolute synonym of *Pleurogobius* Seale (Philip. Journ. Sci., A., iv., November, 1909, 536), with *Pleurogobius boulengeri* Seale, as genotype.

*Galera* Herre (*loc. cit.*, 87 and 103) is preoccupied by *Galera* Gray (Syn. Cont. Brit. Mus., ed. 44, 1842, 12 and 16), a genus of mammals, and may be renamed *Herrea*, in honour of its founder, with *Galera producta* Herre as orthotype.

The generic name *Priolepis* dates from Cuvier and Valenciennes (Hist. Nat. Poiss., xii., March, 1837, 67) who quote it from an evidently unpublished figure in the manuscripts of Ehrenberg. The haplotype is *P. mica* (Ehrenberg) Cuv. and Val., the Red Sea form of the Pacific *Gobius semidoliatus* Cuv. and Val. Thus *Priolepis* replaces *Zonogobius* Bleeker (Arch. Néerl. Sci. Nat., ix., 1874, 323) whose genotype, *Gobius semifasciatus* Bleeker, is said to be a synonym of *G. semidoliatus*.

## AUSTRALIAN DOLICHOPODIDAE (DIPTERA).

By G. H. HARDY,

Walter and Eliza Hall Fellow in Economic Biology, Queensland University,  
Brisbane.

This catalogue is published in order to supply a demand for an introduction to the described members of Australian DOLICHOPODIDAE, which family has been largely neglected in the Commonwealth, because of the lack of a comprehensive scheme whereby the species may be identified. In his work on the Indo-Australian forms, Becker incorporated but few of those previously described from Australia, but most of them are listed, and he completely ignored White's work on the Tasmanian species, which are not easily brought into line with the system used by Becker. Many of the problems and perplexities that confront one when attempting to arrange species and genera proposed by prior authors into a definite scheme of classification have not been solved, owing to the absence of several described species in the collection before me. This collection contains the largest number of Australian species yet brought together, nevertheless five of the genera are missing, or perhaps they are not recognised owing to faulty definitions, for some are defined without regard to affinities, and the characters upon which they are based may be specific, not generic. Also there is room for considerable improvement in forming the genera amongst the CHRYSOSOMATINAE, where characters used lead to an artificial grouping, and some natural groups are swamped in the medley of genera thus diagnosed.

I have felt it incumbent upon me to simplify the key to sub-families and genera as much as possible, so no attempt has been made to draw up a key that will be applicable to all forms before me. Although the key provided will be found to cover only the majority of forms, exceptions may be disregarded despite their comparative frequency, because once a small collection representative of all sub-families has been got together, it will be found that these exceptions can be placed without difficulty, due to the fact that members of each sub-family have general features in common, giving them a somewhat characteristic appearance.

In the keys, the genera and species recognised in the collection before me are marked by an asterisk (\*).

*Key to Sub-families and Genera of the DOLICHOPODIDAE.*

- |  |                              |    |
|--|------------------------------|----|
| 1. Upper median vein forked. . . . .   | CHRYSOSOMATINAE.             | 2. |
| Upper median vein simple. . . . .  |                              | 5. |
| 2. Arista placed quite apically. . . . .   | * <i>Chrysosoma</i> .        |    |
| Arista placed sub-apically, dorsally or basally. . . . .   |                              | 3. |
| 3. Arista issuing from (at most) a very small tubercle. . . . .  |                              | 4. |
| Tubercle from which the arista arises is, in length, about<br>four times that of its width. . . . .                                | <i>Megistostylus</i> .       |    |
| 4. Scutellum with normally two marginal bristles; others, if<br>present, weak and white. . . . .                                   | * <i>Sciapus</i> .           |    |
| Scutellum with four marginal bristles. . . . .   | * <i>Condyllostylus</i> .    |    |
| 5. Acrostichal bristles absent. . . . .  | CAMPSICNEMINAE.              |    |
|  | * <i>Sympycnus</i> .         |    |
| Acrostichal bristles present. . . . .  |                              | 6. |
| 6. Second segment of antennae with a thumb-like pro-<br>longation that reaches on to the third. Arista placed<br>apically. . . . . | RAPHINAE. <i>Syntormon</i> . |    |

- Second segment of antennae normal, without such a prolongation. . . . . 7.
7. Acrostichal bristles uniserial, or mainly so. HYDROPHORINAE. 8.
- Acrostichal bristles biserial for their complete length. (Exception may be found in Medeterinae, but in such a case the flattened area on the thorax would indicate that family). . . . . 10.
8. Antennae with segment 3 short in both sexes. Anterior femora with two rows of bristles below. . . . . \* *Hydrophorus*.
- Antennae with the third segment elongate at least in the male. . . . . 9.
9. Upper median vein straight, more or less parallel to the radius. . . . . *Liparomyia*.
- Upper median vein bent, not parallel to the radius. . . . . *Paralipthus*.
10. Postocular area with only a single row of bristles, not hairy. . . . . 12.
- Postocular area with numerous hairs. . . . . DIAPHORINAE. 11.
11. Arista placed sub-apically. . . . . *Chrysotus*.
- Arista distinctly placed dorsally. . . . . \* *Diaphorus*.
12. Area of thorax above scutellum flat, or even slightly concave. . . . . 14.
- Area of thorax above scutellum normal, convex. . . . . DOLICHOPODIDAE. 13.
13. Upper median vein bending upwards, touching or nearly touching the radial. . . . . \* *Paraclius*.
- Upper median vein not reaching the radial. \* *Dolichopus*.
14. Abdomen short, conical; very small species. MEDETERINAE. 15.
- Abdomen long; larger species. . . . . NEUROGONINAE. 16.
15. Anal vein wanting. . . . . \* *Thypticus*.
- Anal vein present. . . . . \* *Medetera*.
16. Upper median vein strongly bending upwards and at its tip almost reaching the radial. . . . . \* *Neurongonia*.
- Upper median vein but slightly bent, at apex separated from the radial. . . . . \* *Archynomyia*.

#### Sub-family CHRYSOSOMATINAE.

The described Australian species of this sub-family are readily recognised by the branched or forked upper median vein, that is  $M_1$  and  $M_2$  branch from each other beyond the median cell, whereas in all the other sub-families there is only one vein present in this region of the wing, although it is often strongly curved as if the vein  $M_2$  had disappeared. The genus *Mesorhaga* is represented in Australia, though not described from there; this genus is without  $M_2$ , and so the character given above is not applicable in this case. The described forms have been placed under four generic names, and these divisions are recognised as follows:—

*Chrysosoma* has the arista placed apically—that is, at the extreme apex of the third segment of the antennae, whereas in all the others the arista is placed basally, dorsally or sub-apically.

*Megistostylus* has the arista arising from a very long dorsal tubercle, the length being about four times the breadth; this genus is limited to one extra limital species recorded from Queensland.

In the other two genera the tubercle from which the arista arises is very short or apparently absent, but in one, *Sciapus*, the scutellum has but

two marginal bristles, whereas in *Condylostylus* there are four; care has to be taken, however, as *Sciapus* may have an additional pair of short stiff hairs of a light colour, whilst the second pair of bristles on *Condylostylus* may be short, but black.

It would seem that these characters swamp such homogeneous natural groups found amongst the Australian forms, and so they cannot be considered satisfactory from this aspect alone.

#### Genus CHRYSOSOMA Guerin.

*Chrysosoma* Guerin, Voy. Coq. Zool., Atlas, Tab. xx., 25, vii., 1831.—Becker, Cap. Zool., i. (4), p. 114, 1922 (which see for further synonymy).—*Heterospilus* Bigot, Ann. Soc. Ent. France (3), iii., 224, 1859.

#### Key to the Species of *Chrysosoma*; adapted from Becker.

1. Femora yellow or mostly so. . . . . 2.  
Femora mainly black. Antennae black, knees and tibiae yellow, intermediate and posterior femora with one or two short bristles at base, otherwise legs very bare. Wings hyaline, the cross-vein closing the median cell sinuous. 7 mm. long. . . *cingulipes* Walker.
2. Antennae wholly yellow. Thorax black, dull grey dusted, frons similar, wing surface colourless except for a brown spot at both cross-veins (i.e., at base of M1 and at vein closing the median cell); legs and all coxae yellow; first four abdominal segments of male yellow with metallic coloured black spots, in female abdomen almost wholly without yellow spots; hypopygium yellow with long attachments. 6.5–8 mm. . . . . *volucra* Becker.  
Antennae black or black-brown. . . . . 3.
3. Wings clear, at most markings very faintly indicated. Frons white dusted, abdomen at base barely yellow, tarsi brown only at their apices, only the anterior coxae yellow, the others dark. Wings rather greyish, occasionally faintly marked at the anterior border; M1 somewhat recurrent at base, the lower cross-vein strongly sinuous. 7 mm. long. . . . . *chrysurgum* Schiner.  
Wings conspicuously marked. Abdomen with broad dull black bands on anterior edge of segments; third antennal segment almost cone-form, long, three times as long as broad; apical half of anterior femora and four-fifths of hind femora and all tarsi black; wings black-brown on anterior border and a median interrupted stripe, anterior margin very delicately ciliated. 8 mm. long. . . . . *interruptum* Becker.

#### CHRYSOSOMA VOLUCRA Becker.

*Chrysosoma volucra* Becker, Cap. Zool., i. (4), 1922, 142; figs. 74, 75 and 76.

Compare *Sciapus brevicornis* Macquart, which may be identical.

#### CHRYSOSOMA CHRYSURGUM Schiner.

*Psilopus chrysurgum* Schiner, Nov. Reise Dipt., 1868, 214.—*Chrysosoma chrysurgum* Becker, Cap. Zool., i. (4), 1922, 172.

#### CHRYSOSOMA INTERRUPTUM Becker.

*Chrysosoma interruptum* Becker, Cap. Zool., i. (4), 1922, 177; fig. 143.

#### CHRYSOSOMA CINGULIPES Walker.

*Psilopus cingulipes* Walker, Ent. Mag., ii., 1835, 472.—? *Psilopus grandis* Macquart, Dipt. Exot., suppl. 4, 1849, 126.—*Psilopus eximius* Walker, Ins.



Saund. Dipt., i., 1852, 209.—*Chrysosoma alatum* Becker, Cap. Zool., i. (4), 1922, 188; fig. 159.

This is the only species of the genus recognised by me, being represented by a single male from Sydney, dated October 5, 1919. Apparently Walker described it in 1855, and again seventeen years later, whilst Macquart's description seems to conform to the same.

There can be no doubt that Becker's name applies to the one here recognised.

#### Genus SCIAPUS Zeller.

*Sciapus* Zeller, Isis, xi., 1842, 831.—White, Proc. Roy. Soc. Tasm., 1916, 247.—*Sciopus* Becker, Cap. Zool., i. (4), 1922, 196, which see for synonymy.

The name *Sciapus* was used indiscriminately for all species of *Chrysosoma* and allies by White, who drew attention to the Australian forms as being not a homogeneous group. Many species were originally described under the genus *Psilopus*, and *Sciopus* is the name used by Becker. Two new forms are described below, both of which are to be secured in abundance in situations indicated under their descriptions.

#### Key to the Species of *Sciapus*.

1. Wings hyaline, unmarked. . . . . 2.  
Wings with black or brown fascia. . . . . 4.
2. Third antennal segment yellow, long and triangular, length twice the width at its base, arista placed basally. . . . *anomalicornis* Becker.  
Third antennal segment black, short, about as long as wide, arista placed sub-apically. . . . . 3.
3. Wings of the male with a marginal kink at the apex of M2; a species of moderate size with abdomen metallic green and dark bands at incisions. . . . . \* *anomaliipennis* n.sp.  
Wings of the male normal; very small species with yellow abdomen, but metallic towards the apex and with a dark line at incisions of the segments. . . . . \* *triscuticatus* n.sp.
4. Fascia of the wings isolated not joined together at the costal margin. . . . . 5.  
Fascia of the wings conspicuously joined together at costal margin by a more or less broad stripe. . . . . 6.
5. Small species (3—3.5 mm.) with fascia attaining the costal margin or almost so; cross-vein closing the median cell straight. . . . . \* *discretifasciatus* Macq.  
Large species (6—7 mm.) with the fascia restricted to the base of vein M1 and to the sinuous cross-vein closing the median cell. . . . . \* *brevicornis* Macq.
6. Fascia of wings restricted to two cross-bands broadly joined at the costal margin, the strip uniting them reaches the lowest radial vein; base of M1 slightly recurrent, the cross-vein closing the median cell straight. . . . . \* *connexus* Walker.  
Fascia of wings containing two cross-bands narrowly joined by a strip that only reaches the middle radial vein; there is also a spot on the cubital vein and another infuscation at the apex of the first radial vein. . . . . \* *ingenius* Erich.

#### SCIAPUS ANOMALICORNIS Becker.

*Sciopus anomalicornis* Becker, Cap. Zool., i. (4), 1922, 199; figs. 172, 173.

#### SCIAPUS INGENIUS Erichson.

*Psilopus ingenius* Erichson, Arch. f. Nat., viii., 1842, 273.—*Psilopus trifasciatus* Macquart, Dipt. Exot., suppl. 4, 1849, 126; pl. xii., fig. 8.—*Sciapus*

*trifasciatus* White, Proc. Roy. Soc. Tasm., 1916, 248.—*Chrysosoma trifasciatus* Becker, Cap. Zool., i. (4), 1922, 176.—*Sciopus plumifer* Becker, Cap. Zool., i. (4), 1922, 206; figs. 183, 184.

Habitat: Tasmania, Victoria and New South Wales. Very common from Hobart to the Blue Mountains, from December to March.

#### SCIAPUS CONNEXUS Walker.

*Psilopus connexus* Walker, Ent. Mag., ii., 1835, 471.—*Psilopus pachygyna* Macquart, Dipt. Exot., suppl. 3, 1848, 37; pl. iv., fig. 1; and suppl. 4, 1849, 128.—Schiner, Nov. Res. Dipt., 1868, 212.—*Sciopus pachygyna* Bergoth, Stett. Ent. Zeit., lv., 1894, 72.—*Sciopus pachygyna* Becker, Cap. Zool., i. (4), 1922, 209; figs. 192, 193.

Habitat: New South Wales and Queensland. Very common, specially so in banana plantations, and is to be found most months of the year, becoming very scarce in mid-winter.

#### SCIAPUS DISCRETIFASCIATUS Macquart.

*Psilopus discretifasciatus* Macquart, Dipt. Exot., suppl. 4, 1849, 127; pl. xii., fig. 9.—*Sciopus discretifasciatus* White, Proc. Roy. Soc. Tasmania, 1916, 250.—*Sciopus depinctus* Becker, Cap. Zool., i. (4), 1922, 210; figs. 196, 197.

Habitat: New South Wales. Common in Sydney during November. Not known to occur in Tasmania, which is Macquart's locality.

#### SCIAPUS BREVICORNIS Macquart.

*Psilopus brevicornis* Macquart, Dipt. Exot., suppl. 4, 1849, 124; pl. xii., fig. 4.—*Sciopus brevicornis* White, Proc. Roy. Soc. Tasmania, 1916, 249.

The figures given by Becker for *Chrysoma volucre* equally apply to this species, so if Becker has made an error in antennal structure, his species would need to be removed to this position.

Habitat: Tasmania. Not uncommon during December and January. The identification is based on the description given by White rather than that by Macquart.

#### SCIAPUS ANOMALIPENNIS *n.sp.* (Text figs. 1 and 2).

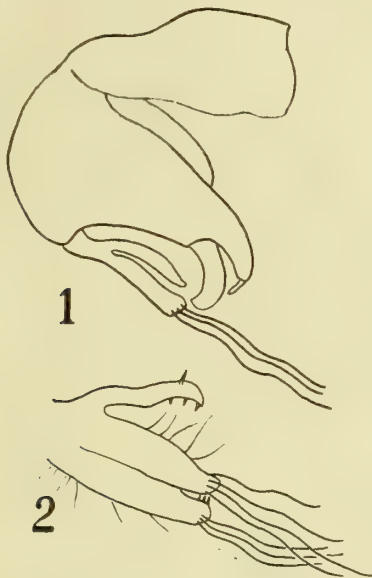
♀. Metallic green, reddish in parts, and slightly white dusted. Antennae with the basal segments yellow, the third black. Proboscis and palpi yellow with black bristles. Hair behind head white. Thorax green above, bluish below. Abdomen green with black incisions; segments 5 to 7 somewhat coppery; hairs white. Genitalia black with white lamellae; bristles and hairs black. The lamellae are bifid, the larger branch of each terminates in three or four elongate sinuous black sub-apical bristles; there are short, black, spine-like bristles at the apex of the larger branch, and a few more scattered on the smaller branch of each lamella; also there are medium sized lateral bristles on the main structure. Coxae bluish; femora tibiae and tarsi yellow. Wings hyaline with a large kink in the border at the second median vein where a chitinous spot occurs, otherwise the venation is normal, yellow to brown in colour; halteres yellow.

The female is similar, but normal in the shape of the wing. The abdomen has only five visible segments. The reddish colour may extend over practically the whole of the female.

Length: 5–6 mm.

Habitat: Queensland, Brisbane. This is one of the most abundant forms in the bush, where it may be found running in numbers up and down the trunks of *Eucalyptus micrantha* (Scribbly Gum). The dates range

from September to January, but specimens are to be found during most months of the year. The type series is a very extensive one, thirty being in my own collection, including the holotype and allotype. There is a long series of paratypes in the Queensland Museum.



Genitalia of *Sciapus anomalipennis* n.sp.

1. Male lateral view.
2. The lamella of same, seen from a more ventral angle.

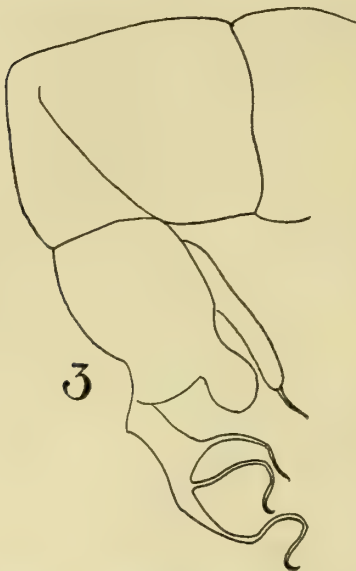
*SCIAPUS TRISCUTICATUS* n.sp.

♀. Head, thorax, scutellum and coxae metallic blue-green, elsewhere mainly yellow. Antennae and proboscis yellow, bristles black, hair white. Abdomen with first segment in part, metallic green, as also the apex of the fourth and whole of the fifth; apex of the second to third fuscous. The genitalia are yellow and each of the two lamellae are provided with three whip-like filaments, one at the apex and two on the outer border.

The female is similar, but the abdomen has only four visible segments, all yellow and margined with metallic green, which colour spreads on to the dorsum of the two last segments. Also the anterior and posterior coxae are yellow.

Length: 3—4 mm.

Habitat: Queensland, Brisbane. This is the species that is most persistently to be found in buildings on windows. It is also to be taken along hedges in gardens, but the majority of the type series were collected in the former position. It occurs from October to June, but is probably to be met with during other months. New South Wales: Sydney, 1 female, February, 1920.

Genitalia of *Sciapus triscuticatus* n.sp.

3. Male lateral view.

Genus *CONDYLOSTYLUS* Bigot.

*Condylostylus* Bigot, Ann. Soc. Ent. France (3), vii., 1859, 223.—Becker, Cap. Zool., i. (4), 1922, 216.

Judging from original and subsequent descriptions, I can detect four species hitherto named, that come within this group. There are about ten species before me, but it is somewhat difficult to ally the sexes. The males of three are provided with hook-shaped cilia along the costal margin of the wing, but this is not seen by me on any female. Only two species are definitely recognised by a name.

*Key to the Species of Condylostylus.*

1. Costal margin of the wing with long hook-shaped cilia.
  - Males. . . . . 2.
  - Costal margin of wing without such cilia. . . . . 4.
2. Antennae with long stiff black bristles which are very conspicuous, forming a whorl. Legs entirely black. . . . . 3.
  - Antennae with less conspicuous bristles which are short. Tibiae yellow. . . . . \* *sp.*
3. With only a few long black bristles on or near the humeral angle of the thorax. . . . . \* *amoenus* Becker.
  - With numerous long black bristles at or near the humeral angle of the thorax. . . . . \* *nigropilosus* Macquart.
4. Legs entirely black, anterior tibiae with short white hair below; with two protuberances towards the apex of the femora and another near the base of tibiae. Wings with vein M1 recurrent at base.



Male and female. . . . . *australiensis* Schiner.  
Anterior tibiae at apex broadly yellow; vein M1 branching at right angles, not recurrent at base. Female. . . . . *viduus* Schiner.

CONDYLOSTYLUS AMOENUS Becker.

*Condylostylus amoenus* Becker, Cap. Zool., i. (4), 1922, 219; fig. 203.

There are three forms that agree with the character of having hook-shaped cilia along the costa of the wing, as illustrated by Becker. A male before me is from Como, New South Wales, October, 1921, and a female that probably belongs to the same species is from Sydney, December, 1918. They are referable to Becker's species, and the costal cilia seems to be limited to the male.

CONDYLOSTYLUS NIGROPILOSUS Macquart.

*Psilopus nigropilosus* Macquart, Dipt. Exot., suppl. 2, 1847, 56.—*Sciapus nigropilosus* White, Proc. Roy. Soc. Tasmania, 1916, 251.

Only a single specimen is before me, from Tasmania, Hobart, October, 1916; and would seem to agree with White's interpretation of Macquart's species.

CONDYLOSTYLUS AUSTRALIENSIS Schiner.

*Psilopus australiensis* Schiner, Nov. Reise. Dipt., 1868, 216.—*Condylostylus australiensis* Becker, Cap. Zool., i. (4), 1922, 219; fig. 202.

CONDYLOSTYLUS VIDUUS Schiner.

*Psilopus viduus* Schiner, Nov. Reise, Dipt., 1868, 216.—*Condylostylus viduus* Becker, Cap. Zool., i. (4), 1922, 220.

Genus MEGISTOSTYLUS Bigot.

*Megistostylus* Bigot, Ann. Soc. Ent., France (3), 1859, 222.—Becker, Cap. Zool., i. (4), 1922, 220.

MEGISTOSTYLUS LONGICORNIS Fabr.

*Musca longicornis* Fabricius, Syst. Ent., 1775, 783.—*Dolichopus crinicornis* Wiedemann, Analecta Entom., 1824, 39.—*Megistostylus longicornis* Becker, Cap. Zool., i. (4), 1922, 230; and as *Megistostylus crinicornis* on fig. 216.

CHRYSOSOMATINAE of Uncertain Generic Position.

*Psilopus angulosus* Bigot, Ann. Ent. Soc. France (6), x., 1890, 283.

*Sciapus chalceus* White, Proc. Roy. Soc. Tasmania, 1916, 250.

*Psilopus dispar* Macquart, Dipt. Exot., suppl. 4, 1849, 125; pl. xii., fig. 5.—

*Sciapus dispar* White, Proc. Roy. Soc. Tasmania, 1916, 251. (? *Condylostylus*).

*Psilopus gemmans* Walker, List. Dipt. Brit. Mus., iii., 1849, 644. (? *Condylostylus*).

*Psilopus nigrofasciatus* Macquart, Dipt. Exot., suppl. 4, 1849, 126; pl. xiv., fig. 6. (? *Condylostylus*).

*Psilopus sydneyensis* Macquart, Dipt. Exot., suppl. 1, 1846, 55; pl. xi., fig. 16; and suppl. 2, 1847, 56.—White, Proc. Roy. Soc. Tasmania, 1916, 251.

*Psilopus sublectus* Walker, Ins. Saund. Dipt., i., 1852, 211.

*Psilopus tricolor* Walker, Ent. Mag., ii., 1835, 471. (? *Condylostylus*).

*Psilopus venustus* Walker, Ins. Saund. Dipt., i., 1852, 209.—(Compare this West Australian species with *Chrysosoma volucre* Becker).

CHRYSOSOMATINAE erroneously included as Australian.

*Psilopus conicornis* Macquart, Dipt. Exot., suppl. 1, 1846, 248.—This species was described as from Pondichery and l'île Sidney. The latter locality is associated with several Australian species by Macquart, and many

of those forms are regarded as being from Sydney, New South Wales. This can scarcely apply to the present species, because Becker has recognised it as being *Chrysosoma leucopogon* Wiedemann, known to occur from India to Formosa, and is not known from Australia.

Note: Since this catalogue was completed, a recent paper containing descriptions of Australian Dolichopodidae has come to hand, namely, that of O. Parent, in *Mitteilung Zool. Mus.*, Hamburg, xliii., 1928, pp. 190-198. Three species are recorded there from the Commonwealth, none of which I have been able to identify.

p. 197. *Chrysosoma diversicolor* Parent, from Queensland, is based on a male and is said to be easily recognised by the abnormal coloration of the femora; the anterior ones are yellow, the others black.

p. 191. *Sciopus proximus* Parent, from New South Wales, has the wing pattern and venation of *S. connexus*, but the genitalia are like those of *S. ingenuus*, only the lamellae are somewhat triangular and very short, just of such a shape as might be expected on a specimen of *ingenuus* if the lamellae were to be broken near the base.

p. 193. *Sciopus sordidus* Parent, from New South Wales, is based on a female whose characters agree in the main with that described above as *S. anomalipennis*; it differs in two or three respects, however, the chief is in the venation which has the "Transverse postérieure légèrement en S, un peu oblique."

#### Sub-family CAMPSICNEMINAE.

##### Genus SYMPYCYNUS Loew.

*Sympycynus* Becker, *Cap. Zool.*, i. (4), 1922, 93.

Many species belong here, and one of them from Southern Queensland, is closely related to *S. praecipuus* Becker, from New Guinea.

##### SYMPYCYNUS ANOMALIPENNIS Becker.

*Sympycynus anomalipennis* Becker, *Cap. Zool.*, i. (4), 1922, 103; fig. 62.

Habitat: New South Wales: Sydney, June, 1917. Queensland: Brisbane, November, 1927, and June, 1929. These three specimens are apparently all males, and one of them was taken when sweeping grass beside a hedge of *Duranta*.

#### Sub-family HYDROPHORINAE.

##### Genus HYDROPHORUS Fallen.

*Hydrophorus* Becker, *Cap. Zool.*, i. (4), 1922, 40.

There are two species, one from near Sydney, the other from Hobart, but neither of them fits Macquart's description. I searched for this genus for several years before finding it, and then took a small series at Como, New South Wales, in 1921, and another series at a water hole near Hobart, situated between the summit of Mount Nelson and the fort near-by; January, 1924. I saw it again flying on the water troughs in the Sydney Botanical Gardens, in April, 1928. The species are very difficult to catch.

##### Genus PARALIPTUS Bezzi.

*Paraliptus* Bezzi, *Austr. Zool.*, iii., 1923, 179.

##### PARALIPTUS MIRABILIS Bezzi.

*Paraliptus mirabilis* Bezzi, *Austr. Zool.*, iii., 1923, 181.

## Genus LIPAROMYIA White.

*Liparomyia* White, Proc. Roy. Soc. Tasmania, 1916, 256.

## LIPAROMYIA SEDATA White.

*Liparomyia sedata* White, Proc. Roy. Soc. Tasmania, 1916, 256.

There is no assurance that this species belongs to the sub-family, and White gives no characters whereby it can be placed, but it is described with uniserial acrostichals.

*Species of Uncertain Generic Position.*

*Hydrophorus cupreus* Macquart, Dipt. Exot., suppl. 4, 1849, 123.—White, Proc. Roy. Soc. Tasmania, 1916, 258.

## Sub-family RAPHIINAE.

## Genus SYNTORMON Loew.

*Syntormon* Becker, Cap. Zool., i. (4), 1922, 55.

## SYNTORMON AEMULANS Becker.

*Syntormon aemulans* Becker, Cap. Zool., i. (4), 1922, 57.

## Sub-family DIAPHORINAE.

This appears to be a large group in Australia that needs very careful consideration. A revision of the described forms is urgently needed, but there are no named specimens in Australian collections that will aid in the work, and some years must pass before sufficient material from the type localities has accumulated. Three species are before me.

## Genus DIAPHORUS Meigen.

*Diaphorus* White, Proc. Roy. Soc. Tasmania, 1916, 253.—Becker, Cap. Zool., i. (4), 1922, 66.

## DIAPHORUS INTACTUS Becker.

*Diaphorus intactus* Becker, Cap. Zool., i. (4), 1922, 73.

## DIAPHORUS UNICOLOR Becker.

*Diaphorus unicolor* Becker, Cap. Zool., i. (4), 1922, 75.

## DIAPHORUS SETOSUS White.

*Diaphorus setosus* White, Proc. Roy. Soc. Tasmania, 1916, 254.

## DIAPHORUS COMMUNIS White.

*Diaphorus communis* White, Proc. Roy. Soc. Tasmania, 1916, 255.

## DIAPHORUS MINOR Meigen.

*Diaphorus minor* Becker, Cap. Zool., i. (4), 1922, 77.

## Genus CHRYSOTUS Meigen.

*Chrysotus* Becker, Cap. Zool., i. (4), 1922, 86.

## CHRYSOTUS ADSIDUUS Becker.

*Chrysotus adsiduus* Becker, Cap. Zool., i. (4), 1922, 89.

## Sub-family DOLICHOPODIDAE.

## Genus DOLICHOPUS Latrielle.

*Dolichopus* Becker, Cap. Zool., i. (4), 1922, 6.

I believe I am correct in placing one species from Brisbane in this genus, which seems to have been recorded from New Guinea and Aru Island, although Becker only recognised it from considerably north of these islands.

Genus *PARACLIUS* Bigot.

*Paraclius* Becker, Cap. Zool., i. (4), 1922, 11.

There are two species of this genus from Brisbane—seven specimens of one, and eight of the other. I am unable to identify Becker's species in either of them.

*PARACLIUS NEGLECTUS* Becker.

*Paraclius neglectus* Becker, Cap. Zool., i. (4), 1922, 16.

## Sub-family MEDETERINAE.

Genus *MEDETERA* Fischer.

*Medetera* Becker, Cap. Zool., i. (4), 1922, 48.

There are several species from Queensland and Tasmania that seem to belong here.

*MEDETERA EXTRANEA* Becker.

*Medetera extranea* Becker, Cap. Zool., i. (4), 1922, 49.

Genus *THYPTICUS* Gerstaecker.

*Thypticus* Becker, Cap. Zool., i. (4), 1922, 54.

This genus is also represented from Queensland and Tasmania.

*THYPTICUS ABDITUS* Becker.

*Thypticus abditus* Becker, Cap. Zool., i. (4), 1922, 54.

## Sub-family NEUROGONINAE.

Genus *NEUROGONA* Rond.

*Neurogona* Becker, Cap. Zool., i. (4), 1922, 61.

*NEUROGONA DENUDA* Becker.

*Neurogona denuda* Becker, Cap. Zool., i. (4), 1922, 62; fig. 44.

Specimens from Brisbane are evidently this species which is recorded from Kuranda (Queensland), Formosa, India and Assam.

Genus *ARCHYNOMYIA* White.

*Archynomyia* White, Proc. Roy. Soc. Tasmania, 1916, 252.

There are two species represented from Tasmania, and one from the National Park, Queensland. It would seem to form quite a valid genus.

*ARCHYNOMYIA ARGORUM* White.

*Archynomyia arborum* White, Proc. Roy. Soc. Tasmania, 1916, 253.—*Archynomyia cupreus* Hardy, Proc. Linn. Soc. N.S. Wales, xlv., 1921, 300.

I do not think my previous suggestion that *Hydrophorus cupreus* Macquart, may be this species, will be maintained. Macquart's specimens are more likely to be from Sydney, not Tasmania as recorded, and also *Hydrophorus* has subsequently been discovered, together with a complex of species that may belong to the same sub-family, but none of which conform to the three genera already placed there.

Habitat: Tasmania, Hobart, Wedge Bay, Triabunna and Dunalley. January to March, 1915, 1917 and 1918. One male, 3 females.



SOME NOTES ON *OLIGOTOMA GURNEYI* FROGGATT.

(EMBIARIA : OLIGOTOMIDAE.)

By E. H. ZECK.

(Plate xv.)

The insect illustrated on the accompanying plate was drawn from a freshly chloroformed specimen before the body had time to shrivel.

The Order EMBIARIA embraces a group of small delicate insects, of which less than a hundred species are known throughout the world, and up to the present time some six species only are known to occur in Australia, all of which are representatives of the family OLIGOTOMIDAE. Practically nothing is known of their life histories, but it is recorded that two species studied by Grassi (Atti. Acc. Gioenia, vii., 1893) lived under stones where they spun webs, by means of glands on the expanded tarsal segments of their fore-legs, using these webs as a means of progression.

The first record of their existence in Australia was published in 1904, when two species, *Oligotoma gurneyi* and *O. agilis* (1), were described by Mr. W. W. Froggatt (Proc. Linn. Soc., N.S.W., Vol. xxix., 1904, 672-3). Another species, *O. hardyi*, has been described by Dr. K. Friedrichs (Rec. W. Aus. Mus., 1914, 241-3). *O. glauerti* was later described by Dr. R. J. Tillyard (Jour. and Proc. Roy. Soc., W.A., Vol. ix., 1923, 64-68). Dr. Tillyard also states (2) that an undescribed species exists in Queensland, and another in Tasmania. An interesting account and record of their occurrence in Victoria has been given by Miss J. W. Raff (Vict. Nat., Vol. xlv., 1929, 238-9).

Brief description of specimen: General colour, brown, more or less shiny; legs somewhat darker than body; eyes black. Head moderately large, covered with hairs; more than half as long again as wide, oval; behind the eyes the head forms an almost complete semicircle. Eyes projecting at the sides.

Antennae inserted in front of and close to the eyes; 18 segments, hairy. (I was unable to determine whether this antenna was complete; the other only possessed 12 segments).

Thorax at its widest part as wide as the head; hairy laterally and ventrally; a few scattered hairs on pronotum. On both the meso- and metanotum there are a few minute hairs, situated towards their anterior longitudinal grooves; elsewhere these parts are glabrous.

Wings: The basal posterior edges of both the fore and hind wings appear to continue on backwards around the somewhat triangular shaped meso- and metanotum respectively. Some of the veins are only represented by a short basal portion which passes into the pigmented band. The borders of the pigmented areas are marked by a row of numerous small hairs and a row of similar hairs also continues on, from the ends of the short basal portions of veins present, to the wing margins. Hairs are numerous upon the anterior portions of both pairs of wings. Both the fore and hind wings bear a small cross vein near their base, which passes from the cubitus to the anal. This vein does not appear in the figures of *Oligotoma hardyi* Fried., or *O. glauerti* Till. (3).

(1) *O. agilis* Froggatt has been listed as the female of *O. gurneyi* Frogg., in (Enderlein, G.) Coll. Zool. de Selys Longchamps., fasc. 3, 1912, 93.

(2) Insects of Australia and New Zealand, 1926, 122.

(3) Jour. and Proc. Roy. Soc. W.A., 1923.

Abdomen of 10 segments, flattened, 4th segment broader; terminal segment with a pair of asymmetrical two-segmented cerci which are covered with numerous hairs. The entire abdomen hairy, and with numerous small irregular darker markings scattered over it.

Dimensions: Length 11 mm., across outstretched wings 19 mm.

Habitat: Taken on window curtains at Summer Hill, Sydney, New South Wales, during October, 1920, by Mrs. E. H. Zeck.

I am indebted to my friend Mr. W. W. Froggatt for the identification of the specimen.

*O. gurneyi* Frogg. appears to come closer to *O. glauerti* Till., than to *O. hardyi* Fried., both as regards its venation and structure of the terminal appendages.

Observations: The terminal abdominal appendages were drawn as seen, without recourse to a clearing agent. It is unfortunate that the example was destroyed whilst in transit abroad, as a further examination of these appendages would have been of much interest.

During the month of September, this year, female Embiids were observed in tunnels under the bark of various trees at Ryde, N.S.W., but no males were found in association with them. Some of the webbed tunnels appeared to contain only a single individual, but in other galleries Embiids of various sizes were noted. It is hoped that later males will be found in association with the females in these galleries, so that the species may be definitely determined.

In conclusion, I would add that were it not for the fact that it had been kept alive, after being captured by my wife, it would have been impossible to have figured this delicate and fragile insect as it is now presented.

## THE BEES OF AUSTRALIA.

By PROFESSOR T. D. A. COCKERELL.

University of Colorado, U.S.A.

There are, in all, 1,037 species of bees known from Australia (1), if we include fifty-eight which have been described and accepted for publication, but not actually published at the time these lines are written (August 10th, 1929), (2). There are, in addition 90 forms which are treated as sub-species or varieties. When they are better known, some of the supposed sub-species will doubtless take specific rank; but on the other hand, some of the recognised species will be united, the sexes having been given different names. Although the number of described species is so large, it is not probable that we know half of those actually existing. The fauna may contain as many as 4,000 species. This apparently extreme estimate appears justified when we consider that nearly all the collecting has been done in a limited number of localities, and that we know little concerning the bees of the interior of the country, or of the north-west coast. Mr. H. H. Batchelor has begun to send in specimens from Hughenden, in the interior of Queensland, west of the Dividing Range, more than 300 miles almost directly west of Mackay. The result is at once the discovery of large and conspicuous forms, hitherto unknown. There is doubtless a whole new fauna to be collected in that region. Rowland and Gilbert Turner collected intensively from 1883 to 1901 in the region about Mackay, on the Queensland coast. The bees were to have been described by Gilbert Turner, but he died of consumption in 1903, at the age of 37. A set of the bees was sent to Perez in France, but, although he attached manuscript names to many of them, he published nothing, and, so far as is known, made no descriptions. Perez having thus failed to accomplish anything, I was asked to undertake the work, using Turner's main collection, which had been given to the British Museum. After everything had been published, so far as the material permitted, the specimens sent to Perez came into the possession of Dr. H. Friese, who published a large number of descriptions without attempting to find out whether the species had been described by me. In a recent paper (American Museum Novitates, No. 343, 1929), I was obliged to reduce no less than 43 of the Friese names to the synonymy, and some others will doubtless have to follow. The Turner collections from the Mackay district included 97 new species of bees, many of them very striking forms, and some representing new genera. The Turners discovered a new series of excessively minute bees, some with peculiar venation, as the new genera *Turnerella* and *Heterapis*. These little bees often visit the flowers of *Eucalyptus* trees, high up in the air, but when the trees are cut down they are still attracted by the flowers and are within the reach of the collector. They are not confined to the Mackay region, but have been found in large numbers at Brisbane by Henry Hacker, from whose collections I have just published (Mem. Queensland Museum, ix., June, 1929) two new genera (*Zalygus* and *Microdontura*), four new species of *Turnerella*, two of *Euryglossina* and one of *Heterapis*. I had assumed, of course, that bees of this type were peculiar to Australia, but ten years ago I received a species of *Heterapis* (*H. sandakanensis* Ckll., 1919), collected in Borneo.

Although the Turners had found so many species in the Mackay district, Mr. Henry Hacker, collecting in the region about Brisbane, has ob-

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(1) In 1904, 222 species were known; in January, 1913, 583 species.

(2) Since published, *vide Aust. Mus. Rec.*, xvii., 1929, 199-243.

tained 89 new species, and others in different parts of Queensland. Mr. F. X. Williams collected in the region about Halifax, and I recently examined his material, now in the possession of the Museum of Comparative Zoology, Harvard University. The species were in general identical with those obtained by the Turners, with only a few new species (*Nomia*, *Halictus*, *Meroglossa*). There is, however, a largely different fauna at Cairns and Kuranda, principally collected by R. Turner and F. P. Dodd. Some of the species from this district are very conspicuous and beautifully coloured.

Mr. Rowland E. Turner, in a letter dated January 6, 1929, gives the following interesting account of his collecting grounds: "The country in the Mackay district and in some other coastal districts in Queensland is of two utterly different types intermingled, grass with scattered *Eucalyptus* trees on the lower country, and tropical jungle on the hills and along the water courses. The bee fauna of the former class of country is Australian, most of the species frequenting *Eucalyptus* blossom, but the latter class of country has a vegetation mainly Malayan, and the bee-fauna also has many Malayan affinities (*Androgynella*, *Dianthidium* and others). *Eugenia* bushes usually grow on the edge of the jungle along the water courses, and were visited by many bees of an Australian type. Imported plants were not much visited except when related to native plants; thus *Cassia fistula* was visited by many species of *Hylaeus* and *Palaeorhiza*. The larger species of bees, belonging to wide-ranging genera such as *Xylocopa*, *Crocisa* and *Anthophora* were not particular, and frequented *Duranta* hedges. One species of *Meroglossa* visited roses, but this seems to be quite an exceptional case. *Leptospermum*, which is much visited by bees, especially *Paracolletes*, in the southern half of Australia, only grows among the rocks on the top of barren hills in North Queensland, where *Paracolletes* is also much more weakly represented, though some of the species are to be found on *Eucalyptus*. In south-west Australia, where there is no tropical jungle, the bee-fauna is almost entirely Australian, and mostly frequents *Eucalyptus* and *Leptospermum*, though *Pachyprosopis* and some other genera visit other plants. *Euryglossina* and some others of the smallest species are to be found crawling in the sticky cups of the *Eucalyptus* blossom. The pink blossomed West Australian *Eucalyptus ficifolia rosea* is particularly attractive to small bees. In South Africa, imported Australian plants are very little visited by indigenous bees.

In American Museum Novitates, No. 346 (1929) I have given a list of the known bees of the Northern Territory, principally obtained at Port Darwin, where I myself collected on March 12, 1928. The fauna is rather disappointing, with a preponderance of widely distributed genera, though there are species of *Euryglossa*, *Palaeorhiza* and *Turnerella*. A small *Paracolletes* (*P. tropicalis* Ckll.) occurs on Melville Island. There is, on the whole, little to suggest affinity with the fauna of New Guinea. I also visited Thursday Island, where most of the bees were taken at the flowers of the introduced *Antigonon leptopus*, which Mrs. H. M. Pendlebury had previously pointed out to me as being particularly attractive to bees at Kuala Lumpur, in the Federated Malay States. The Thursday Island series is on the whole similar to that from Port Darwin, with the bees and the wasps distinctively Australian so far as species go (3). No one could confuse the collection with one from New Guinea. Murray Island, in Torres Strait, has produced a very distinct species of *Palaeorhiza* (*P. hedleyi* Ckll., 1929), related to Queensland species.

(3) However, I collected *Odynerus mirabilis superbus* (Sauss.) det. Bequaert, which occurs both in Australia and New Guinea.



The Malay or intrusive element in the Australian fauna is characterised by the following genera:—

*Ctenoplectra*, with *C. australica* Ckll., from Claudie River, North Queensland, representing a family not otherwise known from Australia.

*Trigona*, with nine species, one occurring at least as far south as Sydney.

*Allodape*, with eight species, mostly northern, two of them only on Thursday Island.

*Mesotrichia*, with *M. bryorum* (Fabr.), frequently placed in *Xylocopa*.

*Anthidiellum* (species formerly placed in *Dianthidium*) with two species, one of them only on Thursday Island.

*Coelioxys*, four species, one (*C. froggatti* Ckll.) reported as far south as Victoria.

*Nomada*, one species from Queensland (*N. australensis* Perk.).

*Sphecodes*, one species from Queensland (*S. profugus* Ckll.).

It is noteworthy that all these genera occur also in Africa. Such genera as *Crocisa* and *Anthophora* might be added to the list, but they are now very widely disposed in Australia, with numerous species.

We naturally think of these insects as having entered Australia in comparatively recent times, but, as Mr. T. Iredale pointed out to me, there is evidence of a Malayan or Oriental snail fauna in North Queensland, which must be of considerable antiquity. As Rowland Turner points out, what we regard as the strictly Australian fauna inhabits a specialised environment, along with a peculiar flora; into this the so-called Malayan elements could rarely successfully penetrate, no matter how long they may have been in the country.

Coming now to the southern part of Australia, I cannot do better than quote a letter written by J. D. Hooker to Darwin as early as 1855:—

"I have just concluded a good and complete catalogue of the Australian Leguminosae. . . . Out of fully 800 species I do not think that there are a dozen common to South-East and South-West Australia; whole well-marked genera containing many sections and species are absolutely confined to S.W. Australia. There is nothing like this in any other part of the world; it is utterly astounding, and, though I thought myself well up in the Australian flora, I was not prepared for this to such an extent. Also taken as a whole, the flora of Tasmania does not present as many species hardly distinct from S.E. Australia as it ought. The Tasmanian species are either very distinct or quite the same, and what is most curious this applies as well to the alpine plants, though the climate of the Australian Alps must be a good deal different from that of the Tasmanian ones." (Life and letters of Sir J. D. Hooker. Vol. I., p. 448).

Much more recently, Emily H. Pelloe (Wild Flowers of Western Australia, 1921) has stated that W. Australia has about 4,000 species of wild flowers (not including over 2,000 of the tropical north-west), of which more than 3,000 are peculiar to that region.

These botanical facts are strongly reflected in the bee-fauna. It is in South-western Australia that we find an extraordinary abundance of species, belonging in large part to characteristically Australian genera. Rowland Turner collected for a time at Yallingup, near Cape Naturaliste, and got 46 new species. Dr. A. J. Nicholson, of the University of Sydney, obtained a small collection in the Geraldton district, and most were new, the species showing little in common with the Yallingup lot. The most remarkable was the large and handsome *Stenotritus nicholsoni* Ckll., forming a new sub-genus (*Ctenocolletes*), strongly suggestive of the South American *Caupolocana*. He also found a series of new species of *Euryglossidia*, which on closer study is seen not to belong to the Hylaeidae, but to be a *Diphaglossine* with two cubital cells, analogous to the South African

genus *Strandiella* of Friese. Still, again, George Masters secured some bees a number of years ago at King George's Sound, and these also represent a distinctive fauna, with several fine new species. Thus Western Australia not only possesses a very peculiar bee-fauna, but includes several faunulae, with special species of their own. The results obtained from a few collections in different parts of this great region certainly indicate a rich harvest remaining for anyone who will go at the proper season and collect in districts not yet explored by those interested in wild bees. The best results would be obtained through the co-operation of an entomologist and a botanist, the latter identifying the flowers visited by the bees.

Botanists have sometimes been sufficiently interested to collect bees. We are indebted to Von Mueller, the famous authority on the Australian flora, for the discovery of *Halictus luteoaeus* Friese and *Nomia testaceipes* Friese. Schomburgk, who was Director of the Botanical Garden at Adelaide, discovered the species *Euryglossa chrysocerus* Ckll., *E. sinapipes* Ckll., *E. schomburgki* Ckll., *Hylaeus chrysaspis* Ckll., *H. dromedarius* Ckll., *Halictus clelandi* Ckll., *Parasphcodes schomburgki* Ckll., *P. sextus* Ckll., *Megachile adelaidae* Ckll., *M. semicandens* Ckll., *M. sequior* Ckll., and *M. trichognatha* Ckll. The types of all these are in the Berlin Museum.

Ludwig Preiss, who settled on Swan River in 1838, is remembered for his many contributions to the knowledge of plants, but also for his discovery of certain bees, as *Megachile preissi* Ckll. and *Anthophora preissi* Ckll. His specimens are at Berlin.

In 1916 (Proc. Acad. Nat. Sci. Philadelphia, p. 360) I listed 79 species of bees from Tasmania, in contrast with the meagre fauna of 18 known from New Zealand. Since that time, the Tasmanian list has been augmented, but new collections continue to emphasise the fact that Tasmania is faunally very close to Victoria, with the species at least in large part identical (4). Extending the thought suggested by Hooker, we may say that whenever Tasmania possesses strongly marked endemic species, they must be supposed to have survived there, and died out on the mainland. But the separation of Tasmania is so recent, that there is little evidence of divergence of type in the species isolated by that separation. The condition of affairs is in many respects similar to that of the British Islands in relation to the Continent of Europe.

Wherever bees are studied, it is found that some of the species are very widely distributed, while others are of much more limited range. This difference is likely to be correlated with flower-visiting and nest-building habits. The bees which we call polytropic, which gather nectar and pollen from many kinds of plants, are naturally likely to be of wide range; while the oligotropic bees, confined to one or a few species of plants, are commonly more restricted. These relationships have not been worked out in Australia, but it is a fact that certain species range over a vast territory. Some examples are the following:—

*Paracolletes carinatus* Sm., Tasmania to Kuranda, Queensland.

*P. plumosus* Sm., Swan River to Sydney.

*P. vigilans* Sm., Swan River to Tasmania.

*Callomelitta littleri* Ckll., Tasmania to National Park, Queensland.

*Euprosopis elegans* Sm., Adelaide to Brisbane.

*Megachile doddiana* Ckll., reported from W. Australia and Townsville, Queensland.

*M. chrysopyga* Sm., W. Australia to Tasmania and Brisbane.

(4) A very distinct species, *Hylaeus xanthosphaera* Ckll., was taken by J. A. Kershaw on King Island, and has not been found elsewhere.

*M. erythropygæ* Sm., Perth to Melbourne.

*M. quinquelineata* Ckll., W. Australia, and Melbourne to Cape York.

*Euryglossina hypochroma* Ckll., Perth and Brisbane.

There are indications that southern (e.g., Tasmanian) species may be found at higher altitudes northward, but at present we have very little material from the uplands and mountains, at least with distinct indication of the altitude. Careful collecting in various mountain localities is sure to give results of great interest. My wife went to the Jenolan Caves, N.S.W., at a most unpromising time of year (April 29th), yet of three species of *Parasphcodes* obtained, one was entirely new (*P. wilmattæ* Ckll.), and one was a sub-species of a Tasmanian species.

The first Australian bees to be described were collected by Banks and Solander on Captain Cook's first voyage, and were made known by Fabricius. These were *Mesotrichia bryorum*, *Lestis bombylans*, *Megachile mystacea*, *Hyleoides concinna* and *Anthophora cingulata*; the last not published until 1804. The *Hyleoides* was very naturally taken for a wasp, and described under *Vespa*. A letter written in 1773 by the English entomologist Drury refers thus to the work of Fabricius:—

"I think you remember Mr. Fabricius. He is now in London and very busy in making descriptions from Mr. Banks' and my collections, where he will have employment for some months, a pleasure he seems to enjoy with as much glee as a Lover of Wine does ye sight of his Cellar when well stored with full Casks and Bottles, enjoying by anticipation ye pleasure he is to receive in emptying them."

One other bee from the collection of Banks, and said to be from "Nova Cambria," was described by the Rev. Wm. Kirby in 1802 as *Melitta cyanura*, and is now known as *Hylæus cyanurus* (5). I found in the British Museum a species identified as that of Kirby (see Ann. Mag. Nat. Hist., February, 1910, p. 138), but it differed from the description in having a black abdomen. Kirby describes his insect as follows: "Caput. Frons utrinque ad oculos macula magna irregulari flavescente. Antennæ nigrae. Truncus. Collare utrinque flavum. Tubercula flava. Scutellum puncto rotundo flavicanti insignitum. Squamulae nigrae. Alae subhyalinae, nervis nigris. Pedes nigri. Abdomen nitidissimum, atro-violaceum, lucidum, levissime punctulatum."

(5) Mr. Robert B. Benson has found what appears to be the type of *Hylæus cyanurus* (Kirby) in the Banks collection at the British Museum. It is a female and has no label. He finds that it agrees with no species given in my tables in Ann. Mag. Nat. Hist., 1910, and is not the species called *cyanurus* in the general collection at the Museum. It is about 7 mm. long, black, with an obscure bronze and bluish metallic tinge on abdomen. The punctures of head, mesonotum and postnotum are very strong and coarse. On the clypeus the punctures tend to be drawn out into longitudinal furrows. The yellow markings include lateral face marks, very broad below, but rapidly narrowing at level of antennae, and ending very acutely on orbital margin far up on sides of front; tubercles yellow, pronotum, with "the hind dorsal margin with a thin yellow line broken in the middle"; very small yellow spots on scutellum (hemispherical in outline) and post-scutellum (obtusely sub-triangular). Abdomen with puncturation very fine, the large spaces between the punctures shining, though the surface is very finely rugulose. This description is partly derived from the sketches sent by Mr. Benson. I conclude that the species has not been obtained in modern times. This is not very surprising as, for instance, Banks and Solander collected insects on Palm Island, whence we have no bees.



In some respects this appears nearer to *H. rotundiceps* Sm., described from Melbourne. After a considerable interval, the next addition was from the voyage of the "Coquille," a species described by Guérin in 1830 as *Andrena* or *Mellitidia australis* (6). Taschenberg (1883) admits the genus *Mellitidia* into his system in his table separating it from *Nomia* by the ocelli being in a triangle; the second cubital cell rectangular, decidedly higher than long, receiving the first recurrent nervure about the middle. The second recurrent nervure joins the third cubital cell beyond the middle. The marginal cell is pointed on the costa. Mandibles broadened, on inner side briefly tridentate. Antennae with slender flagellum. Region of scutellum with a tubercle or point. This bee has not been recognised in recent times, and I have nothing which seems to fit this description. (I do not possess the original work, but only Taschenberg's version).

In 1835 Boisduval described *Crocisa lamprosoma*, of which he said: "Cette belle espece est indiqe comme de Vanikoro, mais je le crois plutot d'Amboine ou de Celebes." Vanikoro is far out in the Pacific, 167°E., 11°, 40min. S. The insect is a well known member of the fauna of Queensland and New South Wales. The *C. caeruleopunctata* of Blanchard, 1840, appears to be the same.

The early voyagers were not always careful about localities; in 1841 Lepeletier described a *Crocisa novae-hollandiae*, said to be from New Holland, but it actually inhabits Amboina.

In 1841 or 1842, Erichson described *Prosopis alcyonea*, *Hylaeus familiaris*, *Andrena infima* and *A. chalybeata*, all from Tasmania. The *Prosopis* is easily identified as the *P. vidua* Smith, 1853, now called *Hylaeus alcyoneus*. *Andrena chalybeata* is now known as *Paracolletes chalybeatus* (cf. Mem. Q'ld. Mus., ix., 1929, p. 311). *Andrena infima* is perhaps, but not certainly, an earlier name for the common *Halictus lanarius* Smith (cf. Trans. Amer. Ent. Soc., xxxvi., 1910, p. 236). It is a male, with apex of clypeus yellow; the face densely white-haired. *Hylaeus familiaris* is a much smaller (female) *Halictus*, not clearly recognisable from the description. It is said to have the margins of the tergites piceous, without bands, indicating such a species as *H. mesembryanthemi* Ckll., or possibly *H. helichrysi* Ckll., or *H. pulvitectus* Ckll. It is safe to exclude *H. helichrysi*, a Queensland species; but *H. pulvitectus* is Tasmanian, and *H. mesembryanthemi* is common in Victoria, and may well occur in Tasmania. It is too large for *H. mesembryanthemi*, and is excluded by the black antennae, front with a mixture of black hairs, and fuscous nervures and stigma. There is more resemblance to *H. pulvitectus*, except for the "fronte pilis intermixtis nigris," but it may well be a species not since collected. The length is said to be 2-2/3 lines.

At Oxford, in the Hope Museum, I found specimens of *Halictus* collected by Darwin on the voyage of the "Beagle," in Australia and Tasmania. They were ordinary looking, and without literature or specimens for comparison. I was not able to identify them. I regret now that I did not make descriptions, from which I could doubtless have placed them on my return home. They were, of course, new species when collected (7).

(6) I now learn from Dr. J. Bequaert that *Mellitidia australis* Guérin was actually collected at Port Praslin, New Ireland (Bismarck Archipelago). It is therefore not a member of the Australian fauna, in spite of having been treated as Australian all these years.

(7) Mr. Robert B. Benson informs me that bees labelled 44.4 at the British Museum (e.g., the type of *Paracolletes plumosellus* Ckll.) were collected by Mr. B. Bynoe, surgeon on H.M.S. Beagle. Bees labelled 56.94 (e.g.,



So far, the knowledge of Australian bees was extremely fragmentary, but F. Smith, of the British Museum, from 1853 to 1879, published 186 species, including many of those most commonly found. Some of the names proved to be preoccupied, and substitutes were provided by Dalle Torre in his Catalogue (1896). It is much to be regretted that Smith did not trouble himself to cite the collectors, and frequently (perhaps for lack of better knowledge) gave only "New Holland" or "Australia" as the locality. The types in the British Museum show that he copied what was on the labels, but probably in some cases more information might have been obtained. In the paper of 1868 seven species are cited from the collection of Sir John Lubbock, and it is known that the ten species from Champion Bay, Western Australia, were all obtained by H. Du Boulay. A remarkable bee, forming a new genus, had previously (1864) been named *Thaumatocoma duboulayi* by Smith.

Smith did not describe all the Australian material available to him. I have had to describe many species from British Museum specimens, dating back to Smith's time. I think the oldest date (as shown by the accession numbers) is 1844 (cf. *Paracolletes plumosellus*). Since the time of Smith species have been described by Alfken of Bremen (3), Cockerell (759), Friese (43, not counting those definitely known to be synonyms), Froggatt (*Megachile blackburnii*), Gribodo (*Anthophora scymna*), Meade-Waldo of the British Museum (7), Meyer of Darmstadt (5 *Parasphcodes*), Mocsaý (*Trigona cincta*), Perkins (13), Radoszkowsky (3), Rayment (3), and Strand (*Euryglossa endeavouricola*). Mocsaý's *Trigona* was actually described from New Guinea, and the Australian representative is a distinct sub-species, *T. cincta percincta* Ckll. The name of Linnaeus comes into the list on account of his *Anthophora zonata*, and the introduced honey-bee.

Several collectors of the modern period have already been mentioned, but it is important to mention the very numerous discoveries of W. W. Froggatt and C. French in New South Wales and Victoria. Thus, for example, no less than nine species of *Exoneura* were first found by Froggatt. Smaller contributions, but some of them of considerable importance, have been made by E. Allen, G. F. Berthoud (W.A.), F. L. Billingham (Bacchus Marsh), Horace Brown (W.A.), T. G. Campbell, J. S. Clark (Swan River), J. Burton Cleland (W.A.), C. E. Cole (Tasmania), Coulon (Port Philip, specimens in Berlin Museum), W. H. Davidson (Queensland), H. W. Davey (Bright, Victoria), A. P. Dodd, Hy. Edwards (the American actor and lepidopterist, who visited Australia), S. W. Fulton (Victoria), Miss A. M. Fulton (Croydon, Victoria), C. Gibbons (N.S.W.), G. F. Gill (Victoria), G. H. Hardy, R. Helms, G. F. Hill, H. J. Hillier (Hermannsburg), Harold Hockings (species of *Trigona*, with biological observations), R. Illidge (Cunderdin, W.A.), R. Kelley (Healesville, Victoria, a wonderful collection from flowers of *Eucalyptus calophylla rosea*, sent to Professor Poulton at Oxford), Wm. Kershaw, Arthur M. Lea, F. M. Littler (Tasmania), A. Musgrave, W. R. Salter (N.S.W.), F. P. Spry, W. Stalker (Alexandria), A. J. Turner (Queensland), H. W. J. Turner (Perth), J. J. Walker (on the "Penguin" Expedition, including the remarkable genus *Phenacolletes* from Turtle Bay), G. A. Waterhouse, F. E. Wilson (Victoria), C. M. Worsfold (W.A.), and others. This long list shows that there has been a good deal of interest in collect-

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the type of *Paracolletes providellus* Ckll.) were collected by Mr. Stutchburg between Sydney and Moreton Bay. Bees labelled 69.50 (e.g., the type of *Paracolletes rudis* Ckll.) were purchased from Mr. Du Bouley, collected in W. Australia, at Nicol Bay, Swan River and Champion Bay.

ing Australian bees, and suggests that when it is made possible for amateurs to identify their species, the bees may become favorites with them.

Friese obtained many species secured by Frank on a journey to Australia, and described several as new. The dates seem to show that Frank did not remain long in any one place, and there is reason to believe that part of the material was given to him by Australian entomologists. Two specimens of *Paracolletes* bear Froggatt's labels. Specimens in the Berlin Museum are ascribed to Rolla, but I understand that he merely sold the specimens, and presumably did not collect them.

The greatest number of types of Australian bees will be found in the British Museum, including those of Smith and Meade-Waldo, and very many described by myself. The American Museum of Natural History in New York has 28 types of species and varieties described by myself, and a long series of the Australian types of Friese. It has been the custom of Friese to label all his co-types "type," without designating holotypes; and his collection, now in Berlin, contains another set of "types" of these species. The Museum of Comparative Zoology (Harvard University) has six types, and the type of *Halictus melanurus* Ckll. is in the U.S. National Museum. The Berlin Museum has many types of my species, as well as those of Friese and Meyer.

In Australia, the largest and richest collection is doubtless that in the Queensland Museum, beautifully arranged by Mr. Hacker, to whom we are indebted for the invaluable Catalogue of Australian Bees, published in the Memoirs of the Queensland Museum, 1921. This collection is now rich in types and determined species. Next comes the series in the Australian Museum at Sydney, also kept in excellent order, and now enriched by numerous types of species described by me in Rec. Aus. Mus., xvii., 5, p. 199. The National Museum of Victoria, at Melbourne, has a smaller series, but includes some very good things. There is a fair number of types and co-types. At the present time, the Australian student has access to a very much larger number of determined bees than was the case a few years ago. I still have in my possession a great many types of Australian species, which have been very necessary for my studies. But I hope in time to transfer most of these to Australia, especially when I can secure in return other specimens of the same species, which I can verify before parting with the types. I have not been willing, in America or Australia, to work up collections and return the types to private collectors, because such a policy is likely, in the long run, to lead to serious losses. I should make an exception in the case of a large collection of some well known student of bees, which was sure to go intact to a reputable museum. It cannot be too strongly emphasised that a type is, from its nature, to be regarded in a manner as public property. It is proper to add, in this connection, that access to types does not necessarily ensure accuracy of determinations. I have known cases where errors were made in such comparisons, when the slightest attention to the descriptions would have revealed the mistakes. Indeed, I myself often read my own descriptions before making comparisons, to call to mind the particular specific characters. The best discipline for the student of bees, whether young or experienced, is to make tables of the species in hand. This it is often difficult to get students to do. They would rather avoid the trouble, and rely on general impressions. It is my custom to construct a table or key for any considerable series of species to be determined, leaving it for subsequent investigation to determine what they are and if any are new.

The habits of Australian bees have been little studied, but will abun-

dantly repay investigation. Some work has been done by Mr. H. Hacker at Brisbane, but the most interesting studies have been made by Mr Tarlton Rayment at Sandringham, Victoria. With the utmost enthusiasm he has watched and recorded the nesting habits of the species of his neighbourhood, discovering many hitherto unrecorded facts. In 1928, I had the pleasure of visiting his favourite localities in his company, though unfortunately not at the best season of the year.

If I may express a personal wish in relation to Australian bees, it is that I may live to see some young student, man or woman, take up the study in Australia and have sufficient perseverance and skill to carry it far beyond the present stage. Indeed, why should there not be half a dozen such students? In that case it would no longer be necessary to send collections across the ocean for determination, and Australia would have the satisfaction of mastering her own problems in this field, as she has done in so many others.

#### APOIDEA (8).

The bees are to be regarded as constituting a superfamily Apoidea, closely related to and presumably derived from the fossorial wasps. In some cases (e.g., *Phenacolletes*) it is at first sight hard to determine whether an insect is a bee or a wasp; but, as Edward Saunders long ago pointed out, all bees, even parasitic species, have some plumose hairs, while the fossorial wasps have them all simple. This fact may be taken as evidence, if such were needed, that the parasitic bees are derived from nest-building forms; and when we come to study parasitic bees in detail, it is evident that they themselves are variously related to and derived from different families of working bees. Any attempt to reconstruct the phylogeny or lines of descent of the bees must necessarily result in a fan-like diagram. Although we can assert with considerable confidence that certain genera are genetically related (thus the parasitic *Psithyrus* derived from *Bombus*), the origin of the families evidently goes a long way back, to a time of which we have no record. It is easy to prove that certain types cannot have been derived from certain other ones, but quite a different matter to determine their actual origin.

It has been customary to regard the bumble-bees (*Bombus*) as very advanced, on account of their long tongues, reduced palpi and social habits. Nevertheless, they show primitive characters in the wings. The sawflies, admittedly standing at the base of the hymenopterous series, frequently show two marginal or radial cells, a dividing vein descending, usually obliquely, from the apical portion of the stigma. In such a wasp as *Zaspilotihynnus*, the base of the radius as understood in sawflies is preserved, and the marginal nervure is strongly looped up to the stigma, so that the marginal cross-vein is excessively short. This wasp, however, surely has two marginal cells, in the same sense that the sawflies have two. Now even in *Bombus*, the rudiment of the cross-vein in the first cubital cell is plainly visible, and it may be said that it also has two marginals. (Cf. Ann. Mag. Nat. Hist. Oct., 1927, pp. 433-434).

Hair on the eyes is found in the genus *Glyptapis*, from Prussian amber, and may be an ancient character. In the modern fauna it is seen in the honey-bee (*Apis*), in the totally different (parasitic) genus *Coelioxys*, in

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(8) I assume that the reader is in possession of some good general work such as Tillyard's "Insects of Australia and New Zealand," and as far as possible avoid the repetition of what may be readily found therein. I also assume the possession of Hacker's catalogue.



the again wholly diverse Australian *Trichocolletes*, and to a slight extent in some other genera. It does not seem at all probable that hairiness of the eyes can be taken in any sense to indicate relationship, but it appears to represent a latent tendency cropping out here and there.

With regard to the tongue, it is entirely reasonable to regard the short tongue as primitive, the long one as more advanced. The length of the tongue increases as an adaptation to the flowers from which nectar is obtained. This culminates in the South American *Euglossa* (*Glossura*) *piliventris* Guerin, in which the tongue is much longer than the body, and when folded back sticks out behind like a tail. In former times, it was very convenient to divide the bees into two great sections, one with the tongue short and blunt, usually more or less emarginate or notched, and the other with the tongue, whether long or short, acutely pointed. The distinction appeared to be fundamental and absolute. However, Perkins (Proc. Hawaiian Ent. Soc., 1908), describing the new Australian genus *Palaeorhiza* (type *Prosopis perviridis* Ckll.), proposed a family Palaeorhizidae, on the following grounds:—

"*Palaeorhiza* is evidently represented by many species in Australia. Several have been described as belonging to the genus *Prosopis*, in spite of the fact that the most superficial examination shows that these insects have an acute lanceolate tongue. Hitherto no connecting link between the blunt-tongued and acute-tongued bees has been recorded, but in *Palaeorhiza* we have a form, which, except for the structure of the tongue, would be assigned to the section of Obtusilingues. It will therefore be obvious that this section and the Acutilingues can no longer be maintained as of great importance, since *Palaeorhiza* must always be associated with *Prosopis*, as the male genital characters, and all other ones, save the lingual, clearly show. In this connection, however, it is only proper to add that the Australian genus *Meroglossa*, associated by Smith with the blunt-tongued bees, without remark, has an acute tongue, being so figured and described by that author."

This extraordinary condition of affairs naturally led me to examine the material in my possession, with the result of discovering a still more extraordinary circumstance, that the males of those two genera do in fact have acute tongues, but the females have them obtuse, as in the related genera! Thus the two sexes, according to the old classification, would fall in quite different divisions of the Apoidea. (Cf. Nature, Vol. 83, 1910, p. 311).

The maxillary palpi are especially instructive from the standpoint of evolution, since there is no doubt whatever that the primitive number of joints is six, and that these undergo reduction in the different genera, being wholly lost in the South American genus *Oxaea*. This reduction has evidently taken place independently in different groups; thus *Oxaea* is not related to the various genera in which the joints are two, three or four, but to *Protoxaea*, which has six-jointed maxillary palpi. A very interesting case is that of the Australian genus of Anthophoridae called *Asaropoda*, in which the maxillary palpi retain the full number of six joints; but the labial palpi, four-jointed in nearly all bees, are reduced to two joints, with a brush of stiff hairs at the end. This has been confused with *Saropoda*, which is a European genus, with four-jointed maxillary palpi. It will be observed that, speaking generally, the reduction in the number of palpal joints is characteristic, not of the endemic Australian genera, but of the genera which evidently evolved elsewhere, and entered Australia with their generic characters fully established.



The maxillary combs are evidently highly significant for taxonomy and the understanding of phylogeny. The combs consist of rows of stiff specialised bristles, placed on the maxilla, and only clearly seen when the mouth-parts are mounted on a slide, and examined by transmitted light under the compound microscope. The inner comb is placed mesad of the palpus, on the basal part of the galea. The outer comb is placed basad of the palpus, on a more or less concave margin of the stipes, or more properly perhaps the united palpifers. The presence of the inner comb distinguishes those bees which are considered less advanced, and the presence of the outer comb those which are very highly modified. *Hylaeus*, *Merglossa*, *Palaeorhiza* and others have the inner comb very well developed; the lacinia in those genera is reduced to a small finger-like structure, beset with bristles. *Nomia* has a well developed inner comb, and narrow lacinia. *Sphecodes* has no inner comb, but it has a primitive feature in the galea, the apical part being distinctly separated, a condition more strongly emphasised in the wasp *Vespa*. *Halictus* has no inner comb, and the terminal portion of the galea is separated by a line or suture as in *Sphecodes*. Thus *Halictus* and *Sphecodes* stand apart from *Nomia*, which has no apical division of the galea. Owing to these facts, I am now inclined, contrary to my former opinion, to accept the family Halictidae as distinct from Andrenidae.

The Anthophoridae, such as *Anthophora*, have a well-developed outer comb. *Megachile* has no inner or outer comb. The margin below the palpus is strongly convex, but presents a certain number of bristles, which in some species are thickened and spiniform. These seem to represent the vestiges of an outer comb. The Megachilidae (except *Anthidium* and close relatives) are outer comb losers, but some other genera of more primitive type presumably had no outer comb ancestry. (Cf. Proc. Ent. Soc. Washington, Vol. 26, April, 1924).

Returning to a consideration of the wings, we can clearly detect an evolutionary series in the suppression of the cells and nervures. The more primitive genera have three cubital (or sub-marginal) cells and three discoidals. Many genera have the cubital cells reduced to two, and when this is the case, it may be the first or second intercubitus which has disappeared, or perhaps the two may have coalesced to form a single nervure. In the North American parasitic genus *Phileremulus*, and in some of the minute Australian Hylaeidae, there is only one cubital cell, while in the Meliponidae (represented in Australia by *Trigona*) the dividing nervures have entirely disappeared, or are represented at best by faint vestiges. Although the loss of a cubital cell indicates departure from the primitive type, this is the condition in the whole group of Hylaeidae, otherwise considered primitive, and in certain members of the Colletoid series.

It is proper to remark, that from the standpoint of strict morphology, we are in error in our nomenclature of the cubital cells. Thus it is obvious that a genus with two cells does not possess just the first and second of other bees, but the first, and it may be the second and third united. This is well understood, and need not give rise to any misunderstanding.

The Australian bees can be divided into a number of families called Hylaeidae (or Prosopididae), Colletidae (of the sub-family Diphaglosinae), Halictidae, Andrenidae (of the sub-family Nominae, or family Nomidae of Robertson), Melectidae (*Crocisa*), Anthophoridae (*Anthophora* and *Asaropoda*), Megachilidae (with sub-families Megachilinae, Anthidiinae, and Coelioxynae), Xylocopidae, Ceratinidae, Meliponidae, and the introduced honey bee, Apidae.

The following key will facilitate the separation of these groups:—

- Cubital cells, obsolete or in part faintly indicated; social bees. . . . . Meliponidae (*Trigona*).  
 Cubital cells, whether one, two or three, clear and distinct. 1.  
 1. Cubital cells two or fewer. . . . . 2.  
     Cubital cells three. . . . . 9.  
 2. Short tongued bees, the tongue obtuse, except in males of  
     some Hylaeidae, but never long. . . . . 3.  
     Long tongued bees. . . . . 6.  
 3. Both cubital cells long, subequal, well developed. . . . . 4.  
     Second cubital cell conspicuously shorter than first, or  
     lacking. . . . . Hylaeidae.  
 4. Second cubital cell broadly and abruptly truncate apically, the cell  
     as broad above as below; rather large bees resembling wasps. . . .  
     . . . . . Hylaeidae subf. Hylaeoidinae (*Hylaeoides*).  
     Second cubital cell narrowed about or nearly half above. 5.  
 5. Abdomen with pale tegumentary bands, incised on each side anteriorly;  
     antennae and hind legs highly modified; marginal cell pointed, the  
     apex away from costa; basal nervure going basad of the very  
     oblique nervulus. Hylaeidae subf. Neopasiphaeinae (*Neopasiphae*).  
     Abdomen without pale tegumentary bands, but frequently tinged with  
     purple; antennae and legs not deformed; marginal cell narrow at  
     end near costa; basal nervure falling short of nervulus. . . . .  
     . . . . . Colletidae (*Euryglossina*).  
 6. Only one recurrent nervure, and therefore only two discoidal cells. . .  
     . . . . . Ceratinidae (*Exoneura*).  
     Two recurrent nervures, and three discoidal cells. . . . . 7.  
 7. Small or smallish bees, with not much hair on body; females with no  
     scopa on abdomen, but one on hind tibiae and basitarsi; face  
     usually with a characteristic pale mark; abdomen never blue. . .  
     . . . . . Ceratinidae [*Allodape*].  
     Rather small thick-set bees, the abdomen shining purple-blue. . . .  
     . . . . . Ctenoplectridae (*Ctenoplectra*).  
     Small or large bees, evidently hairy; females (except in *Androgynella*)  
     with a ventral scopa (pollen-collecting brush) on  
     abdomen. . . . . 8.  
 8. No pale tegumentary markings; no pulvillus or pad between  
     claws. . . . . Megachilidae.  
     With pale or yellow tegumentary marking; feet with pulvilli. . . . .  
     . . . . . Megachilidae subf. Anthidiinae (*Anthidiellum*).  
 9. Bees with short obtuse or emarginate tongues; body hairy. . . . . Colletidae.  
     Bees with pointed tongues, short or long. . . . . 10.  
 10. Marginal cell very long, parallel sided, approaching tip of wing;  
     second cubital very broad below and narrow above; social bees  
     with hairy eyes. . . . . Apidae (*Apis*).  
     Marginal cell not thus elongated; solitary or colonial bees, not forming  
     a community nest. . . . . 11.  
 11. Sixth abdominal segment without a pygidial area or plate; tongue long  
     and filiform; bees making nests in wood or in stems of  
     plants. . . . . 12.  
     Sixth abdominal segment with a pygidial area or plate. 13.  
 12. Small bees, less than 5 mm. long; black, marked with white; second  
     intercubitus strongly curved, nearly meeting the first above;  
     maxillary palpi five jointed. . . . . Ceratinidae (*Neoceratina*).  
     Large robust bees, like bumble-bees, black or metallic. . . . . Xylocopidae.

13. Parasitic bees, without scopa for collecting pollen; ornamented with bright blue or white markings due to appressed scale-like hairs; scutellum modified, emarginate. . . . . Melectidae (*Crocisa*). Nest-making bees, with scopa on the legs of females for collecting pollen; body not ornamented as in *Crocisa*. . . . . 14.
14. Tongue very long, and first two joints of labial palpi strongly modified, elongated and flattened; robust swift-flying bees. . . Anthophoridae. Tongue dagger like or more elongated, but labial palpi not modified as just described; bees mostly of medium size or small. . . . . 15.
15. Second cubital cell short and small, the others large; marginal cell blunt at apex; hind legs of males often greatly modified. . . . . Andrenidae subf. Nominae. Cubital cells more ordinary, and marginal cell more pointed; basal nervure strongly bent or arched; males usually with a yellowish band or mark on apex of clypeus. . . . . Halictidae.

Aside from such characters as are cited above, each group has its general aspect or facies, by which it may usually be known at a glance, once it has become familiar. Additional characters will readily be found; thus the base of the metathorax in *Nomia* is unlike that of *Halictus*, and the Halictine females have a sort of groove or rima, fringed with hairs, at the apex of the abdomen. The commonest Anthophorids have the abdomen elegantly banded with blue or green, but some Nomines are also thus banded. The marginal cell in Anthophora is short, evidently shorter than the first discoidal, and the basal nervure is not arched. *Anthophora* and *Asaropoda* have the third cubital cell large and square, hardly contracted above.

#### Family APIDAE.

The honey-bee, *Apis mellifera* L., is sufficiently well known. One of its specialised characters is that of lacking spurs on the hind tibiae (9).

Many years ago I saw a bumble-bee (Bombidae; *Bombus hortorum* var. *fidens* Harris) said to have come from Queensland. Species of *Bombus* are well established in New Zealand. In the Western Hemisphere there is a native *Bombus* (*B. dahlbohmti* Guerin) existing as far south as Tierra del Fuego.

#### Family MELIPONIDAE.

All the Australian species are small and belong to the genus *Trigona* Jurine. These bees are peculiar for having no sting.

*Trigona carbonaria* Smith. This is the very common little black bee, looking like an animated particle of soot, about 4 mm. long. The pale hair of the thorax above has sparse black bristles intermixed. The flagellum of the antennae is dark beneath, with at most a little red at base and more at apex. The native name, according to Mr. Hockings, is Karbi. Although it is a general rule that native bees are attracted by introduced flowers, there are exceptions, and one of them is *T. carbonaria*, which Mrs. May-banke Anderson found to be attracted in great numbers to sunflowers at Pittwater, N.S.W. (Cf. Entomologist, July, 1914, p. 192). At Rangoon, Burma, I found a similar small *Trigona* (*T. iridipennis* Smith) attracted in numbers to sunflowers.

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(9) Mr. T. Rayment (Australasian Beekeeper, xxvii., October 15, 1925, p. 68) reported the existence of a smaller native *Apis* (*A. aenigmaticus* Rayment) from Victoria and South Australia. But as nothing seems to be known of it but the comb, it cannot be regarded as entitled to recognition until the actual bees are produced.



*Trigona carbonaria angophorae* Ckll. Worker about 4.5 mm. long, intense black, without light markings, but the flagellum ferruginous beneath. Wings blackish translucent, with dark stigma and nervures; legs with black hair. This was found by Froggatt visiting flowers of *Angophora* at Sydney, and was described as a distinct species, but it seems to represent a race or variety of *T. carbonaria*.

*T. carbonaria hockingsi* Ckll. Larger than typical *T. carbonaria*, with much coarse black hair on scutellum, and the flagellum clear red beneath. It was found by H. Hockings on the Cape York Peninsula, and also occurs (with the flagellum more dusky) at Port Darwin. The nesting habits are different, and are described in Mem. Queensland Museum, ix., 1929, p. 301.

*T. cassiae* Ckll. Easily known from *T. carbonaria* by the scutellum, and often the axillae, marked with cream colour. The tubercles also are light-spotted. In the male the flagellum is entirely pale fulvous beneath. It is common in Queensland, nesting in hollow trees, and commonly visiting *Cassia* flowers, but also *Eucalyptus*. The native name, according to Hockings, is Kootchar. He has given a good account of its nesting habits (Mem. Queensland Museum, ix., 1929, p. 299, continued on p. 301).

*T. cincta percincta* Ckll. A very small species with light face-markings, pale scutellum, and a pale band along each side of mesothorax. The species was described from New Guinea, but an Australian race, appreciably larger (up to 5 mm. instead of 3.5) occurs at Hermannsburg, Finke River.

*T. australis* Friese, found by Baron von Muller in Central Australia, and also reported from Queensland, has the scutellum partly pale as in *T. cassiae*, but is said to have yellow mandibles and red-brown clypeus. The axillae are entirely yellowish white. Length, 4 mm. I infer from the description that true *T. australis* is a species I have not seen, but probably the variety from Mackay, cited by Friese, to *T. cassiae*.

*T. essingtoni* Ckll., from Port Essington, is 4 mm. long, with pale yellow markings, as follows: Mandibles (except ferruginous tips), labrum, clypeus (except narrow, black, anterior and posterior margins, and two large red-brown spots on disc), wedge-shaped lateral face-marks, extending to level of antennae, tubercles, narrow stripe on each side of mesothorax, extending to level of antennae, tubercles, narrow stripe on each side of mesothorax, extending to axillae, all of scutellum, and apex of abdomen, the last being thinly pubescent with white hair. Wings hyaline, nervures and stigma flavous.

*T. mellipes* Friese, with no better locality than South Australia, is honey-yellow, with hair of the same colour; antennae blackish-brown above; legs all honey-yellow; wings perfectly clear, iridescent. Length less than 4 mm.

*T. wybenica* Ckll., found by Hockings on Thursday Island, is very small, head and thorax shining black, with the scutellum, metathorax and sides of thorax posteriorly varying from dull honey colour to black (perhaps a question of maturity). Mandibles light yellowish ferruginous, darker at apex; labrum light yellow; scape entirely clear orange ferruginous; flagellum black or very dark above, reddened beneath, especially apically; abdomen, honey colour or pale yellowish.

*T. laeviceps* Smith. Resembles *T. carbonaria*, but distinguished by the red antennae; the abdomen is dark sepia brown, becoming black apically. It occurs in Queensland and the Northern Territory (Adelaide River), and was first reported in error as *T. canifrons* Sm. (Cf. Mem. Queensland Mus., vii., 1922, p. 279). Even now, there is some uncertainty, as recent studies indicate that the *T. laeviceps* of authors includes more than one species.



Family XYLOCOPIDAE.

Large robust bees not metallic; second cubital cell produced and incomplete basally. . . . . *Mesotrichia* Westwood.  
Bright green or blue bees; second cubital cell approximately parallel-sided, complete, not strongly produced at base (the venation therefore less modified than in *Mesotrichia*). . . . . *Lestis* Lepeletier.

*Mesotrichia* Westwood.

*Mesotrichia bryorum* Fabricius. The female is a large black bee, the thorax covered with dense very bright yellow hair. The male has the abdomen also yellow haired. It is a common insect in Queensland, but has been reported as far south as New South Wales. The bees of this genus are known to possess a peculiar pouch in the base of the abdomen, which harbours mites of the genus *Paragreenia*. Miss N. Le Veque has discovered the interesting fact that the Australian species lacks this pouch, and therefore harbours no mites.

*Lestis* Lepeletier.

*Lestis bombylans* Fabricius. Male with thorax and abdomen yellowish green, the thorax in front with fulvous hair, with three longitudinal suffused dusky bands. Female bright blue-green. Queensland.

*L. aerata* Smith. Male with thorax and abdomen bluish-green, with blue shades on thorax; front much narrower than in *L. bombylans*; thorax in front with three black bands and fulvous between them; light area on face pellucid or opaque white. Female bluer than in *L. bombylans*. The var. *violascens* Kkil. (male) has much violet colour on abdomen. The var. *gibbonsi* Kkil. (National Park, N.S.W.) described from a male, has the black band on middle of thorax in front broader; thorax above yellowish green, the shining disc of mesothorax golden green; abdomen shining yellowish green with strong pink and lilac suffusion.

This species appears to be more widely distributed than *L. bombylans*, extending from North Queensland to Victoria.

Family CERATINIDAE.

Anterior wings with three cubital cells. . . . . *Neoceratina* Perkins.  
Anterior wings with two cubital cells. . . . . 1.  
1. Anterior wings with two recurrent nervures. . . . .  
. . . . . *Allodape* Lepeletier and Serville.  
Anterior wings with one recurrent nervure. . . . . *Exoneura* Smith.

*Allodape* was based on a South African species, but the genus is widely distributed in Africa and Asia, extending to Australia. *Exoneura* is an Australian derivative from *Allodape*; it is an example of an Australian genus which is less primitive than its relatives in other parts of the world. The Syrian *E. libanensis* Friese, which I have from Brumana (*Morice*), appears to represent an independent development, and is now placed in *Exoneuridia*. *Neoceratina* was based on peculiarities of the palpi and venation, but Perkins overlooked the fact that the type of *Ceratina* (*C. cucurbitina* Rossi) has five-jointed maxillary palpi (cf. Ann. Mag. Nat. Hist., Dec., 1899, p. 405). *Neoceratina* is therefore very close to *Ceratina*, but should be readily recognisable by "the recurrent nervures received a short and about equal distance within the second and third cubital cells respectively." The only species is *N. australensis* Perkins, 4.5 mm. long, taken by Perkins at Bundaberg, Queensland, in 1904. It is black, with a slight aneous tinge; a wide stripe down middle of clypeus, the tubercles, a spot at base of middle tibiae above and line on front and hind ones are white.

*Allodape* Lepeletier and Serville.

*Allodape bribiensis* Ckll. Female about 4 mm. long; black, the abdomen dullish, not shining as in *A. unicolor*; clypeus with a broad white vertical bar, narrowest at top, and gradually widening downward; scape black; flagellum ferruginous beneath, except at base; tegulae testaceous; tubercles white; legs with white marking. Found by Hacker on Bribie Island, Queensland.

*A. clarissima* Ckll. Male; 6.8 mm. long; like *A. simillima*, but scape with a white stripe in front; clypeus broad, constricted in middle, ivory-white; small lateral face marks; labrum white in middle; tubercles white; tarsi pale red. Thursday Island.

*A. diminuta* Ckll. Both sexes about 5 mm. long; resembling *A. simillima*, but much smaller, and male with scape white in front. Face mark in female broad and pyriform, which readily distinguishes it from *A. unicolor*. Discovered by Froggatt at Yarrawin, N.S.W., but now known to extend north to Thursday Island and Port Darwin.

*A. grisea* Alfken. Male, 4.25 mm. long; black, dull, with thin grey hair; legs marked with yellowish white, and hind margins of abdominal segments above and below yellowish white; wings perfectly clear, iridescent. No mention is made of any pale markings on head. Denham, S.W. Australia, taken on the Hamburg Expedition of 1905. Unknown to me.

*A. picta* Smith. I examined Smith's (male) type in the British Museum. It is recognised by the yellow sides of face, and the abdomen with suffused brown bands. The clypeus is yellow; mandibles and labrum testaceous yellow; antennae pale fulvous beneath; tegulae testaceous; wings clear, nervures testaceous; abdominal tergites 2 to 4 with lateral yellow spots. The length is given as  $2\frac{1}{2}$  lines. The abdominal markings appear to ally it with *A. grisea*. Unfortunately the locality is given as "Australia."

*A. plebeia* Ckll. Male 6 mm. long; like *A. simillima*; but no lateral face marks; facial mark yellowish; very broad above, gradually narrowing to the truncate lower end; labrum all black; antennae entirely black; tubercles cream-colour; stigma very dark. Female about 6 mm.; marked like the male, but more robust. Thursday Island.

*A. simillima* Smith. The largest Australian species; females up to nearly 9 mm. Black, the female with a large pear-shaped yellowish-white area on clypeus, and the tubercles white. The type locality is given as "Macintyre River (Ker)." The species goes north to Thursday Island and Melville Island, and occurs at Brisbane and in W. Australia. It is possible that the species as now understood is composite. The male, as I have it from Mackay, has the clypeus all white, and the sides of the face with narrow white bands. This is Turner's 716.

*A. unicolor* Smith. A small species. Smith described the female as "length  $2\frac{1}{2}$  lines; black and shining, the clypeus having an elongate cream-coloured spot, transverse at the base and pointed at the apex; . . . wings hyaline, their extreme base yellowish, the nervures fuscous." The locality is given as "New Holland," but the species is known to be northern. The male, from Port Darwin and Thursday Island, is less than 4.5 mm. long, and has no lateral face marks. The scape is entirely black. The female may be known from *A. bribiensis* by the lack of white marking on the legs.

The Australian *Allodape* appear to fall in two series; the species of Queensland and the Northern Territory (one extending into New South Wales), which are quite typical of the genus; and the aberrant *A. picta* and *A. grisea*, little-known, and probably confined to S.W. Australia. I possess no material of the second group.

*Exoneura* Smith.

Numerous species have been added since the publication of Hacker's Catalogue. For most of these, see Memoirs, Queensland Museum, vii., December, 1922, where there is a table. In this table, *E. pictifrons* Alfken would fall next to *E. perpensa*, and *E. hamulata* Ckll. next to *E. baculifera*. For a table of the earlier known species, see Ann. Mag. Nat. Hist., November, 1905. The genus is very rich in species, and should be intensively studied by an Australian entomologist. It is remarkable that S.W. Australia seems to be very poor in *Exoneura*, only *E. bicolor*, *E. pictifrons* and *E. angophorae occidentalis* being recorded. There are four species in Tasmania.

*Exoneura abstrusa* Ckll. Male, about 6.5 mm. long; clypeus, labrum and linear lateral face marks clear ivory white; anterior tibiae mainly pale red; hind tibiae claviform, very broad apically; abdomen black. Brisbane (Hacker). Female unknown.

*E. albolineata* Ckll. Female a little over 5 mm. long, with dusky red abdomen; clypeus with a narrow pale yellowish stripe from base to apex, and sides of face with small short pale marks. Dorrigo, N.S.W. (W. Heron). Allied to *E. insularis*.

*E. angophorae* Ckll. Female, length about 6.25 mm.; black, with deep ferruginous abdomen and legs; clypeus with a longitudinal pale yellowish line or band; each side of face with a small pale yellow mark, which may be absent. Allied to *E. bicolor*, but known by the moderately dusky wings, much less reddened than in *E. bicolor*, and the abundant black hair on hind legs. Found by Froggatt at Sydney, visiting flowers of *Angophora*, but known to range north to Brisbane. The var. *obliterata* Ckll. from Brisbane, has the clypeal band dusky, narrow, very obscure; first abdominal tergite nearly all black, except the hind margin (broadest in middle) and broad hind corners. A table contrasting *E. angophorae* with its relatives will be found in Proc. Acad. Nat. Sci. Philadelphia, 1913, p. 32. The subsp. *occidentalis* Ckll. is from Yallingup, W. Australia, and has no light markings on face. The scape is red or yellowish red in front.

*E. aterrima* Ckll. First described as a variety of *E. botanica*, but later raised to specific rank. The female is fully 5 mm. long; abdomen all black, the hind margins of tergites not reddened. Considerably smaller than *E. insularis*, with the tubercles creamy white and the wings not reddened. The male differs by the clypeus (except a very small mark on each lateral margin) and labrum entirely white; the anterior tibiae and the basitarsi black or dark fuscous. Brisbane and Caloundra (Hacker).

*E. baculifera* Ckll. Female somewhat over 6 mm.; black, with the broad abdomen dark chestnut red, the first two tergites mainly black, and a dusky cloud on third; clypeus with a narrow rod-like pale yellow stripe, often subobsolete; tubercles dark. Allied to *E. angophorae* var. *obliterata*, but easily separated by the dark legs and abdomen. It is to *obliterata* what *robusta* is to *hamulata*. National Park, Queensland (Hacker).

*E. bicolor* Smith. This is the common species with red abdomen, with thin short orange hair on the apical part. The type female, in the British Museum, shows the face conspicuously narrowed below; this is an excellent character to distinguish it from the broad-faced *E. hamulata*. The male has the eyes large and prominent, and the face narrow. The range is extensive, from Stanthorpe, Queensland, to Tasmania, and west to Swan River. I took it at flowers of *Hypochaeris*, at Wallangarra, Queensland.

*E. botanica* Ckll. Female very small, less than 4.5 mm. long; black, including the abdomen, but the hind margins of the tergites reddish; face narrow, orbits converging below; clypeus with a very broad cream-coloured band, broadest above, with a sudden enlargement something like the head of a nail; tubercles cream-coloured. Botany, N.S.W. (Froggatt).



*E. brisbanensis* Ckll. Female about 5 mm. long; head and thorax shining black, abdomen rather dark chestnut red, the basal tergite and a broad transverse band on second blackened; face broad (but orbits distinctly converging below), shining, wholly without marking; flagellum red beneath. Allied to *E. froggattii* and *E. concinnula*, but easily separated by the black tibiae. Brisbane (Hacker).

*E. clarissima* Ckll. Male about 5 mm. long, the abdomen bright ferruginous, dusky at sides of apex, and the first tergite black, with a narrow red apical margin. Readily known by the small size and the broad white face-patch, broadly truncate above. Wings not reddened; knees broadly, and all the tibiae and tarsi, bright ferruginous. Yarrawin, N.S.W. (Froggatt).

*E. concinnula* Ckll. Female 4.5 mm. long, like *E. froggattii*, but smaller; the clear reddish wings with the stigma and nervures clear light ferruginous; femora black, red apically; tibiae and tarsi chestnut red; abdomen red without markings. The face is wholly black, but the labrum red. Collected by Froggatt in New South Wales.

*E. diversipes* Ckll. Male about 7 mm. long, known from *E. nitida* by the long black hair of face. The abdomen is black, and the anterior tibiae are dark (in *E. abstrusa* they are mainly pale red). Eyes very large, converging below; face with a very broad reversed T of greenish-white, including all of clypeus except a narrow stripe down each side; lateral marks represented by short slender lines; labrum greenish-white; tegulae black; hind tibiae slender basally and broad apically, their basitarsi long and very thick. National Park, Queensland (Hacker).

*E. excavata* Ckll. Female about 7.5 mm. long, peculiar for the wholly black, excavated and basin-like face; abdomen dark chestnut red, the first tergite with a broad blackish suffusion on disc; anterior knees, tibiae apically, and all the tarsi dark red; in certain lights the middle and hind tibiae appear to be bright red above, but this is due to coppery hair; tubercles black; wings strongly reddish. National Park, Queensland (Hacker).

*E. froggattii* Friese. Female 6 mm. long; head and thorax shining black; face narrow, wholly without light markings; tubercles black; femora black, red at apex, tibiae and tarsi bright chestnut red. The stigma is dusky (clear fulvous in *E. concinnula*). The type locality is Thornleigh, N.S.W. (Froggatt). It also occurs in Victoria.

*E. fultoni* Ckll. Female 5.5 mm. long; known by the small size, red femora, and absence of a cream-coloured clypeal stripe. Lower part of clypeus broadly suffused with red; mandibles red, except at base and apex; legs bright chestnut red; tubercles black; wings dilute reddish; stigma clear ferruginous; abdomen red, sometimes dusky at apex. Croydon, Victoria (S. W. Fulton).

*E. gracilis* Ckll. Female about 4.5 mm. long; slender, black, shining; face wholly black, labrum clear ferruginous; scape in front and flagellum beneath dull ferruginous; tubercles white; tegulae hyaline with a white spot. Distinguished from *E. ploratula* by the black middle and hind femora (in *ploratula* they are clear red). Brisbane (Hacker).

*E. hackeri* Ckll. First treated as a variety of *E. angophorae*; later as a species. The female resembles *E. angophorae*, but has the white clypeal band extremely broad, its upper half broadest, and covering the whole width of clypeus; lateral face marks quite large; triangular; first three abdominal segments with broad dusky bands, or these may be absent. The face marks resemble those of *E. clarissima*, but that has the scape white in front, while in *E. hackeri* it is entirely black. Brisbane (Hacker). The



var. *incerta* Kkll. has the lateral face marks reduced to small spots; stigma clear ferruginous; scape red at base.

*E. hamulata* Ckll. Female not quite 7 mm. long; abdomen chestnut red (a rather darker shade than in *E. bicolor*), the first two tergites each with a large black discal patch; legs red, the coxae, trochanters and greater part of femora black. The face is broad; clypeus with a cream-coloured band suddenly broadened above, with a sharp hook-like extension on each side; wings yellowish. Type from Moss Bay, N.S.W. (Froggatt), but goes north to Brisbane, and south to Tasmania. A Tasmanian variety has the clypeal mark evanescent, all but the upper part dark reddish; wings strongly reddened, stigma clear amber; hair on outer side of hind tibiae ferruginous.

*E. insularis* Ckll. Female about 6 mm. long; black, including abdomen; clypeal and lateral marks cream-colour; clypeus with a very broad median band, which suddenly broadens above, so as to include all of upper part; lateral marks rather small, subtriangular; scape with a red mark near base, and one at apex. Allied to *E. botanica*, but known by the lateral face marks and dark tubercles. Stradbroke Island, Queensland (Froggatt).

*E. melaena* Ckll. Female about 5 mm. long; similar to *E. aterrima*, but differing by the face entirely black; wings dilute reddish; a bright ferruginous patch at each side of base of first abdominal tergite; tibiae largely red, but basitarsi dark. Caloundra, Queensland (Hacker).

*E. nitida* Ckll. Both sexes about 6 mm. long. Female black, with the margins of the fourth and fifth abdominal tergites very narrowly and often hardly perceptibly reddened; face and front highly polished and shining; clypeus with a very broad cream-white band, broadest above; tubercles cream-colour; tegulae black; wings dilute brown, stigma and nervures very dark. Male similar to that of *E. aterrima*, but larger, head broader, creamy-white area on face broader, wings browner. The larger size, brownish wings and black legs distinguish this species from the closely related *E. aterrima*. Stradbroke Island, Queensland (Hacker).

*E. perpensa* Ckll. Male about 6 mm. long; head and thorax black, with long hair, black on head, dull white on thorax, very faintly yellowish dorsally; head transverse, eyes very large and convex; clypeus and labrum greenish-white, the light facial area like a reversed wineglass with an extremely thick stem; no lateral marks; tegulae dark; stigma narrow, ferruginous; abdomen parallel-sided, broad at base (slender basally in *E. bicolor*), first tergite black, second black, with dull red apical margin, fourth red clouded with dusky, fifth and sixth more strongly clouded. Structurally allied to *E. diversipes*, but that has a black abdomen. Armidale, N.S.W. (A. J. Turner).

*E. pictifrons* Alfken. Male 6 to 7 mm. long; black, with red abdomen; clypeus and scape in front yellowish-white. The variety *laeta* Alfken has only the base of the first tergite black, but the typical form has the abdomen more blackened, and in the var. *obscura* Alfken, the tergites are black, with basal and apical red bands. Mundijong, S.W. Australia. *E. angophorae occidentalis* Ckll., based on females from Yallingup, W. Australia (R. E. Turner) is very likely the same species. It has the face narrowed below, all black; scape red or yellowish red in front; wings reddish, with dark stigma; legs largely red. Alfken's name has about seven years' priority. If these are one species, this leaves W. Australia with only two known *Exoneura*. It is possible that Smith's *E. bicolor* from Swan River and Tasmania were different species, the Tasmanian one being the one to which the name is now applied. Meade-Waldo compared *occidentalis* with the type of *E. bicolor*, and reported: "Not *E. bicolor*; differs in colour of hind legs, etc."

*E. ploratula* Ckll. Female hardly 4.5 mm. long; head, thorax and abdomen entirely black, the face without light markings; legs chestnut red, the anterior femora black, except at apex, but the others clear red; scape red in front; wings yellowish hyaline, not dusky, nervures light ferruginous, the large stigma dark red. Resembles *E. froggattii* by the small size and dark face, *E. botanica* by the small size and black abdomen. Sydney, N.S.W., collected by Froggatt at flowers of *Angophora*.

*E. rhodoptera* Ckll. Female about 6 mm. long; very robust, black, the abdomen marked with dark red, at sides of first and second tergites, a pair of hook-shaped marks on second tergite, a transverse band (weak or broken sublaterally) on third, base of fourth, and an indistinct band on fifth; clypeus with a broad median cream-coloured bar, irregular along the margins, and emitting at its upper end very long hook-like extensions; labrum black; tegulae reddish; wings strongly reddish-fuliginous; femora with a pale red stripe above, not reaching base; anterior and middle tibiae and tarsi dark red, hind legs darker. Allied to *E. hamulata*, but with very much darker abdomen, legs and wings. Stradbroke Island, Queensland (Hacker).

*E. robusta* Ckll. Both sexes about 6.5 mm. long. Female robust, black, the very broad abdomen shining dark chestnut red, with the first tergite (except apical margins laterally), nearly all of second, and a transverse arched band on third, black; face very broad, the clypeus with a broad cream-coloured band, variable in form, urn-shaped or hooked at sides above; antennae dark; tubercles black, tegulae black, reddish posteriorly. Male with narrow face, showing long black hair, and no light markings; abdomen darker, even the apical tergites suffused with black. There is a possibility that the male is not conspecific. The female is close to *E. hamulata*, with the same broad face, but easily distinguished by the much darker legs, only partially and very obscurely reddened, if at all. National Park, Queensland (Hacker).

*E. tasmanica* Ckll. Male about or nearly 7 mm. long; abdomen red, suffused with black, first tergite black with red hind margin; clypeus cream-colour; antennae black; knees, tibiae and tarsi clear red, the hind tibiae black posteriorly. Windermere, Tasmania (F. M. Littler).

*E. tau* Ckll. Similar to *E. hamulata*, but smaller (anterior wing 4 mm.); second cubital cell much smaller; clypeal stripe narrow, with a short cross-bar at top, which is not at all hooked; tubercles yellow. By the light tubercles it resembles *E. botanica*, but that has a black abdomen, dark stigma and clypeal stripe very much broader. Moss Bay, N.S.W. (Froggatt).

*E. turneri* Ckll. Female about 8 mm. long; head and thorax black, wholly without light markings; abdomen bright chestnut red, the first tergite with two rather small dusky spots near base; femora, tibiae and tarsi bright chestnut red, anterior femora black at extreme base; face broad; scape with a narrow red stripe in front; wings strongly reddened. Allied to *E. hamulata*, but separated by the entirely black face. Eaglehawk Neck, Tasmania (R. E. Turner).

It will be observed, that of the above 28 species of *Exoneura*, twelve were discovered by Hacker, and nine by Froggatt. We are not informed who discovered the genus; Smith cites the type species, *E. bicolor*, from Swan River and Tasmania.

#### Family CTENOPLECTRIDAE.

*Ctenoplectra australica* Ckll., from Claude River, Queensland, is the only species. Its characters have been given in connection with the table of families.

(To be Continued.)

# THE LORICATES OF THE NEOZELANIC REGION.

By TOM IREDALE, Conchologist, and A. F. BASSET HULL, Honorary  
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Since part II. of this paper appeared (this journal, pp. 75-95) we have seen the Loricates collected by Dr. H. K. Finlay, of Dunedin, including a number dealt with by Edwin Ashby in a paper published shortly after our paper. Amongst these a new species and a new record belonging to the family LEPIDOPLEURIDAE were introduced.

Add to II. Family LEPIDOPLEURIDAE.

## 12a. TERENOCHITON FINLAYI.

(Plate xvi., figs. 2-5.)

1929. *Lepidopleurus finlayi* Ashby, Trans. N.Z. Inst., lx., 372, pl. 32, figs. 5, 6, 7, August 29. 60 fath., Otago Heads, N.Z. Type in Australian Museum (ex Finlay collection).

The essential features of this distinct Lepidopleurid can well be seen in the figures here given, the many-rayed anterior valve contrasting with the distantly placed lirae of the pleural area.

Shell small, elongate oval, elevated, semi-keeled, side slopes somewhat curved, girdle scaly.

Colour pale buff to brown.

Sculpture of granules: The anterior valve very closely rayed with rounded pustules, about fifty rays being counted; the pleural area has about twelve rows of large pustules, less and crowded at the jugum, widely spaced and much larger towards the girdle; lateral area closely rayed as the anterior valve and showing marked growth periods, four or five being notable.

The mucro is ante-median, the posterior slope somewhat steep and a little concave.

Girdle scales minute, elongate, rather erect.

Dimensions: Length, 4 mm.; breadth, 2.75 mm. (Holotype: Ashby).

Habitat: Dredged in 60 fathoms off Otago Heads, N.Z.

Remarks: Ashby has written about some strange bunches of spicules observed on the type which he dissected, *but these were not present on the second example*, so apparently were of no import.

## 13a. PARACHITON SUBANTARCTICUS *sp. nov.*

(Plate xvi., figs. 6-7.)

1929. *Lepidopleurus columnarius* Ashby, Trans. N.Z. Inst., lx., 372, pl. 32, fig. 9, August 29. 95 fath., off Auckland Island.

Ashby has added this Tasmanian species to the New Zealand List on the strength of a single valve. We would have ignored the valve, but inasmuch as it has been introduced it must be dealt with. The valve in question is before us as we write. It is quite distinct from the Tasmanian species, with the type of which we have compared it, notwithstanding Ashby's association. Ashby's photograph does not correctly show the form of the valve which is well rounded with scarcely the suggestion of a keel, not Gothic arched as his figure suggests.

A comparison of the two species may be stated as follows:—

*L. columnarius*. Has the valves steeply Gothic arched, sculpture coarser; lateral areas distinctly elevated, showing no well-marked growth



lines; the pleural area shows 20 chains of pustules on each side of the jugum.

*P. subantarcticus*. The valve is distinctly rounded, with very little vestige of carination; the lateral areas are scarcely elevated, showing markedly 4 or 5 growth periods, and is shallower; 25 chains of very fine pustules on each side of the jugum.

The type is in the Australian Museum (ex Finlay collection).

Add to III. Family LEPIDOCHITONIDAE.

17a. *ICOPLAX SUBEUDOKA* sp. nov.

1929. *Callochiton klemi* Ashby, Trans. N.Z. Inst., lx., 375, pl. 32, fig. 12, August 29. Foveaux Strait, N.Z.

Again Ashby has described a N.Z. shell and associated it with an Australian species, so that again it becomes necessary to name the valve figured by Ashby, and fortunately deposited in the Dominion Museum, Wellington.

The differences between the Australian and Neozelanic shells are given by Ashby, and the Neozelanic shell is also quite distinct from *C. sulcatus* Suter. Ashby's description is as follows: "Median valve measures 6.5 x 3 mm., angle of divergence 90°, colour flesh-pink with lighter mottlings, surface smooth, except for growth-lines and minute decussate pattern; ornamented with seven almost circular pits, of which the two outer are imperfectly formed; the pits themselves are very much smaller and the ridges between are much larger, three times the width of those in *C. empleurus*."

"The structure of the pits is very distinct from that of *C. empleurus*, but whether this species is truly conspecific with the unique example from South Australia cannot be stated with certainty until further examples are forthcoming from South Australia, showing the end valves. The short circular character of the pits and the broad interspaces are common to both, but I note that the South Australian shell is more beaked, and the pits are not quite identical, so the receipt of more material may, after all, make separation possible."

#### IV. Family LORICIDAE.

This family, a very characteristic feature of the extra tropical Australian Loricata fauna, appears in the north of New Zealand, a somewhat unexpected occurrence.

The species are few in number, and three genera are recognised in Australian waters, but only one genus and species is so far recorded from the Neozelanic Region. It will be interesting to watch for its discovery in the Neozelanic fossil beds, as the family is well represented in the palaeontology of Australia.

The peculiar posterior valve with its unslit posteriorly sinuate insertion plate, and the scaly girdle more or less interspersed with spiculate tufts, make the members easily recognisable.

#### viii. Genus LORICA.

1852. *Lorica* H. and A. Adams, Ann. Mag. Nat. Hist., ser. 11, vol. ix., 355. Type by monotypy *Chiton cimolius* Reeve.  
 1853. *Aulacochiton* Shuttleworth, Mittheil. Naturf. Gesell. Berne, 68. Type by monotypy *Chiton volvox* Reeve.  
 1926. *Zelorica* Finlay, Trans. New Zeal. Inst., lvii., 334, December 23. Type by monotypy *Lorica haurakiensis* Mestayer.



Shells medium to large, more or less elevated, keeled, elongately ovate, girdle scaly with corneous tufts.

Colour generally dull, sometimes brightly streaked.

Sculpture consists of radial rows of distant pustules on end valves and lateral areas, and raised longitudinal lines of coalesced pustules, sometimes with cross threads, on the central areas.

Girdle notably slit posteriorly, covered with oval scales of different sizes, somewhat loosely packed with scattered spiculose tufts more or less distributed.

Insertion plates large, striated in anterior and median valves; the former eight-slit, the latter one-slit; sutural laminae large, sinus very small, with a projecting subdenticulate block present; posterior valve with an unslit callus somewhat sinuate.

*Zelorica* was provided by Finlay for the Neozelanic species, as the girdle examined showed no spiculose tufts. This conclusion requires confirmation from the study of juvenile specimens as the type species of *Lorica*, *cimolia*, generally has the tufts absent in the adult, but they can be found in very small specimens. The Sydney *Lorica volvox* has very numerous tufts at all stages, well preserved specimens showing three or four rows somewhat alternating.

## 26. LORICA HAURAKIENSIS.

(Plate xvi., fig. 1.)

1921. *Lorica haurakiensis* Mestayer, Trans. New Zeal. Inst., liii., 1920, 177, pl. 38, figs. 1-3, July 4, 1921. Hauraki Gulf, 20 fath., New Zealand.

1907. *Lorica volvox* Suter, Proc. Mal. Soc., iii., 297.

1913. *Lorica volvox* Suter, Man. N.Z. Moll., 46. Atlas, pl. 2, fig. 22, pl. 5, fig. 3 a-b.

1915. *Lorica volvox* Iredale, Trans. New Zeal. Inst., xlvii., 1914, 425.

1924. *Lorica haurakiensis* Finlay, Trans. New Zeal. Inst., lv., 517.

1926. *Lorica haurakiensis* Mestayer, Trans. New Zeal. Inst., lvi., 587, pl. 101, fig. 10.

Not

1872. *Chiton rudis* Hutton, Trans. New Zeal. Inst., iv., 1871, 179. Type in the Colonial Museum; locality not stated. = Sydney, New South Wales.

Many years ago Hutton described a shell, apparently from New Zealand, in the Colonial Museum, as *C. rudis*, and later this was recognised as a species of *Lorica*, determined as the Sydney species, and dropped from the Neozelanic List. Some forty years after Hutton's description Captain Bollons found a species of *Lorica* living in the Hauraki Gulf, and it was recorded as the Sydney species. A specimen was given to Hull by Captain Bollons, and sent to Iredale for comparison with the types in the British Museum. It was found to differ appreciably, but could not be described until comparison had been made with the type of Hutton's *rudis*. This was done by Miss Mestayer, who showed that Hutton's shell was a Sydney specimen, and therefore the Neozelanic species needed description, which was offered as follows:—

"Shell ovately oblong, steeply elevated, dorsal ridge acute, side slopes very slightly convex. Anterior valve erect, lightly curved forward, with fourteen irregularly spaced radial ribs, smooth for about two-thirds their length, but bearing near the girdle from four to six low, steeply rounded nodules; the interstices show faint concentric growth-lines; posterior angles of the apex finely vertically ribbed. Median valves. The first of these is considerably larger than the others, the jugal area sculptured with

oblique radial ribs, which form inverted 'V' up it; pleural areas finely horizontally ribbed. In valves 3 to 8 the horizontal ribbing is continued across the jugal tract. The number of ribs varies with the age of the shell; the holotype has nineteen horizontal ribs, the interstices rather wider and perfectly smooth. The lateral areas raised, somewhat variable, some having one or three more or less decided radial riblets, but they may be obsolete on one or more of these areas. A few low, steeply rounded nodules are rather irregularly scattered over the riblets. Posterior edges of valves denticulate, and showing traces of fine vertical striae at the apex. The concentric growth-lines are clearly visible. Posterior valve the smallest, horizontally ribbed, bounded by a strong slightly upstanding rib, bearing a few nodules. In some specimens there are traces of fine vertical riblets on the posterior angle. The mucro is terminal. The valve rather deeply grooved posteriorly. Girdle medium width, closely set with smooth convex scales, which vary slightly in size. There are no tufts of bristles; the posterior slit extends the whole length of the girdle. Colour reddish-brown with a fairly broad creamy-yellow bar along the centre of the shell. The girdle about the same colour, with darker transverse bars. Individual specimens appear to vary somewhat in colour. Interior reddish, sutural plates almost white, sinus very narrow, rather shallow. Anterior valve with about eight slits, median valves one-slit. Length 30 mm.; breadth 20 mm.

"Off Kawau Island, Hauraki Gulf, N.Z.; 20 fathoms."

#### V. Family CRYPTOCONCHIDAE.

This family is based upon the anomalous Neozelanic species, *Cryptoconchus porosus* Burrow, which is also one of the largest species. The anterior valve is regularly five-slit, sometimes the slits becoming obsolete, but never the regular eight of other families such as the PLAXIPHORIDAE and MOPALIIDAE. Ashby, in his original papers, included *Katherina* in this family, because this genus bears a very superficial resemblance, but the slitting was sufficient to determine its allies, and Thiele had confirmed the location by study of the radula which is typically Mopalioid. The radula in this family is also characteristic, and it is noteworthy that, although Ashby has recommended the usage of this feature, he discarded it in the instances when it was seen to be of great value. Another superficial feature which makes most members recognisable at sight is the non-differentiation of the pleural and lateral areas of the median valves; when these are separated by a rib this is nodulose and in agreement with the remainder of the sculpture, rarely obsolete, still more rarely linear. The girdle generally shows outstanding tufts around the anterior valve, sometimes behind the posterior valve, and at the sutural pores of the median valves; otherwise the girdle is more or less clothed with spicules, sometimes practically naked, at others densely spiculate with long spines. Thus, the development of the huge naked girdle with large tufts (retracted in death) of *Cryptoconchus* is merely an exaggeration of the broad leathery girdle of the other large New Zealand species, *N. violaceus* Q. & G., and the variation in the opposite direction is seen in the Australian *N. speciosus* H. Adams, where the girdle encroaches on the shell in the same manner, and to the same extent, but is thickly covered with long glassy spicules, giving it a very distinctive appearance. Internally the median valves have only one slit, which may become obsolete, but the insertion plates are grossly enlarged and form wing-like processes, leaving only a minute sinus. The posterior valve is likewise distinctive, in that there are two well-marked side slits, rarely obsolete, while sometimes the interspace between the two slits is multi-slit. Rarely

the whole insertion plate of the posterior valve degenerates to a mere callus, and upon the recognition of this sporadic feature in a fossil Ashby has built up a wonderful but flimsy edifice of the evolution of this group.

The difficulty of defining the generic groups in this family has been emphasised by Iredale, and in connection with Neozelanic shells it is even more pronounced than in Australian forms. Ashby has noted this also, and suggesting that there is only one genus has added more complications by treating the same species under different generic and subgeneric names.

On the littoral of New Zealand three distinct groups are easily separated, *Cryptoconchus*, *Acanthochiton* and *Notoplax*. The first-named can never be confused, and at present in Neozelanic waters only one species is allowed; the second was only regarded as monotypic until quite recently, but now the number of species is indefinite and in some cases dredged shells may even be confused with the lastnamed *Notoplax*. *Notoplax* is founded upon a Tasmanian dredged shell of large size, very small exposed tegmentum, huge girdle thickly spiculose. The common large Neozelanic shell has a wide naked girdle, looks very distinct and has been named *Loboplax*. A closely allied species of "*Loboplax*" has the girdle finely spiculose and dredged shells are quite intermediate. When specimens are secured by means of the dredge still more difficulties appear as, although the earliest known was separable at sight, recent accessions have proved difficult to locate generically. Iredale recommended *Craspedochiton*, and this will be here used, as although we at first thought emendation could be made we will show that extreme variability has made differentiation impossible. Ashby has, however, provided two generic names for the Neozelanic species in case a differentiation should be substantiated.

viii. Genus CRYPTOCONCHUS.

1815. *Cryptoconchus* Burrow, Elements of Conch., 1st ed., 190, 1815. ex Blainville MS.

Type by subsequent designation Gray, 1847, *Chiton porosus* Burrow.

This name was introduced as follows in connection with the new species *C. porosus* and *C. larvaeformis*: "They have been examined by Dr. Blainville, of Paris, by whom a communication respecting them, has, it is understood, been made to the French Philomatic Society. The names he has affixed to the two species are *Cryptoconchus porosus* and *C. larvaeformis*." From subsequent literature we can deduce that Blainville intended the genus name to cover the group we now know as *Cryptoplax*, as this name he published later in connection with the same two species. Gray fixed the type of *Cryptoconchus* on the Neozelanic species, and it has been so utilised ever since.

While at first sight this genus appears very peculiar, it really is a very obvious development as seen by the other members of the family. Restricted to New Zealand, the type remained the sole member of the typical *Cryptoconchus* until quite recently, when Nierstrasz (Siboga Exped., 1905, 68) named a second species from the Moluccas, a strange case if the association be confirmed.

Shell large, tegmentum very small, articulamentum very large and strong. Sculpture very restricted but pustulose, dorsal area marked, no differentiation between lateral and pleural areas; insertion plates abnormally large; sinus shallow; anterior valve with normal five-slitting, median valves one-slit on each side; posterior valve five to seven slit; girdle very large, fleshy, sutural tufts present. Gills posterior, and radula characteristic.

As noted above, although *Katharina* has a somewhat similar super-



ficies, it is merely due to convergence, the eight-slit anterior valve indicating at once its true relationship, the long gills confirming this, and the radular features absolutely determining its non-relationship to this group. and its true place in the MOPALIIDAE.

## 26. CRYPTOCONCHUS POROSUS.

(Plate xvi, fig. 8.)

1815. *Chiton porosus* Burrow, Elements Conch., 189, pl. xxviii, fig. 1. "Hab. uncertain, probably New South Wales" = New Zealand. Type in British Museum.
1818. *Cryptoplax depressus* Blainville, Dict. Sci. Nat. (Levrault), xii., 124. Same specimen.
1825. *Chiton leachi* Blainville, Dict. Sci. Nat. (Levrault), xxxvi., 554. Same specimen.
1825. *Chiton porosus* Burrow, Elements Conch., 2nd ed., 178, pl. xxviii, fig. 1.
1829. *Cryptoconchus porosus* Guilding, Zool. Journ., v., 28.
1835. *Chiton monticularis* Quoy and Gaimard, Voy. de l'Astrol. Zool., iii., 406, pl. 73, figs. 30-36. L'anse de l'Astrolabe. N.Z. Type in Paris Museum.
1836. *Chiton monticularis* Deshayes, Hist. Anim. s. Vert. (Lam.), 2nd ed., vii., 519.
1840. *Cryptoconchus porosus* Swainson, Treat. Malac., 358.
1840. *Chiton monticularis* Sowerby, Conch. Illus., fig. 129.
1843. *Amicula monticularis* Gray, Travels in New Zeal. (Dieffenbach), ii., 246.
1847. *Chiton monticularis* Reeve, Conch. Icon., ii., pl. 10, fig. 57.
1848. *Chiton (Symmetrogephyrus) monticularis* Middendorff, Mem. Sci. Nat. Imp. Sci. St. Petersb., vi., 1847, 98. February, 1848.
1854. *Cryptoconchus porosus* H. & A. Adams, Gen. Rec. Moll., i., 482, pl. 55, fig. 4.
1857. *Cryptoconchus porosus* Gray, Guide Distr. Moll. B.M.
1859. *Cryptoconchus porosus* Chenu, Man. de Conch., 383, fig. 2884.
1872. *Cryptoconchus monticularis* Hutton, Trans. New Zeal. Inst., iv., 1871, 183.
1873. *Cryptoconchus monticularis* Hutton, Cat. Man. Moll. N.Z., 51.
1880. *Cryptoconchus porosus* Hutton, Man. N.Z. Moll., 118.
1882. *Cryptoconchus stewartianus* Rochebrune, Bull. Soc. Philom., Paris (7), vi., 194. Stewarts Island, N.Z. Type in Paris Museum.
1883. *Cryptoconchus porosus* Hutton, Trans. N.Z. Inst., xv., 1882, 129, pl. xvi., fig. H. (dentition).
1893. *Acanthochites porosus* Pilsbry, Man. Conch., xv., 36, pl. iii., figs. 57-62.
1897. *Acanthochites (Cryptoconchus) porosus* Suter, Proc. Mal. Soc., ii., 193.
1904. *Acanthochites porosus* Hutton, Index Faunae, N.Z., 86.
1904. *Cryptoconchus (Acanthochites) porosus* Wissel, Zool. Jahrb. Abh. Syst., xx., 618.
1905. *Acanthochites porosus* Hamilton, Col. Mus. Bull. No. 1, 36.
1909. *Acanthochites porosus* Suter, Nachr. Blatt. d. Mal. Gesell., 74.
1913. *Acanthochites porosus* Suter, Man. N.Z. Moll., 27. Atlas, pl. 2, fig. 10, pl. 4, fig. 2.
1915. *Cryptoconchus porosus* Iredale, Trans. N.Z. Inst., xlvii., 1914, 425.
1920. *Cryptoconchus porosus* Mestayer, N.Z. Journ. Sci. Tech., iii., 117 (carnivorous).
1922. *Cryptoconchus (A.) monticularis* Ashby, Trans. Roy. Soc. South Austr., xlvii., 579. (Type examined?).



1922. *Cryptoconchus stewartianus* Ashby, *id.*, *ib.*  
 1924. *Cryptoconchus porosus* Odhner, Vidensk. Medd. Dansk. Nat. Foren. Bd., 77 (N.Z. Moll.), 8.  
 1926. *Cryptoconchus porosus* Ashby, Proc. Mal. Soc., xvii., 27, pl. iii., figs. 2 a-c, April 30. (Co-type of *stewartianus* described).

Burrow's description was brief but somewhat quaint, thus: "Shell 8-valved, carinate, valves with a tooth on each side, covered entirely with the marginal membrane. Specimen pale olive above, sides brown, coriaceous covering cinereous or pale brown, tomentous; perforated over the back of each valve with a small slit and two tubular pores; valves finely striate and irregularly granulate; posterior valve indented in the margin; lateral triangles marked by an obsolete fold, and terminated by a small, sharp, tooth-like process.

Habitat uncertain, but probably New South Wales.

The animal possessing this very curious multi-valve shell differs from the inhabitant of *Chiton* in the arrangement of the lungs, which do not extend so far on either side, but only about one-third of the length; and in the intestinal canal."

When Quoy and Gaimard met with the species in New Zealand they described it as a new species in detail and gave excellent figures.

Rochebrune later named a shell from Foveaux Strait, but the differences noted at present appear to be individual, but the geographic range is abnormal. There appears to be no record of this striking and somewhat obtrusive form from the Chatham Islands or the Subantarctic Islands, an item which may later prove of value.

The form may be shortly described: Shell large, almost covered by the girdle, which is very large and fleshy, the uncovered tegmentum being practically linear and showing mostly the very narrow dorsal area only of the median valves, a minute subcircular spot on the anterior valve and a long line on the posterior valve; the sculpture adjacent consists of a few small flattened subcircular pustules. Colour pale brown. The huge tegmentum is very strong and the anterior valve is five-slit, the median valves one-slit on each side, the posterior valve is many-slit between the regular two side slits, slits varying from five to seven.

Girdle in life bright orange to reddish brown, furnished with eighteen sutural tufts of spicules, appearing to rise out of elevated pockets.

Length of dead specimens over 50-60 mm., but considerably more in life; breadth 25 mm., similarly capable of extension when living.

Habitat: Throughout New Zealand.

#### IX. GENUS ACANTHOCHITON.

1821. *Acanthochiton* Gray, London Medical Repository, xv., 234. Type by monotypy *Chiton fascicularis* Linn.  
 1826. *Acanthochites* Risso, Hist. Nat. l'Eur. Merid. iv., 268. Type by virtual tautonymy *A. communis* = *Chiton fascicularis* Linn.  
 1830. *Phakellopleura* Guilding, Zool. Journ., v., 28. Type by monotypy *Chiton fascicularis* Linn.  
 1847. *Kapellopleura* Reeve, Conch. Icon., iv., introd. text to Plate i. Error for *Phakellopleura* Guilding only.  
 1948. *Hamachiton* Middendorff, Mem. Sci. Nat. Imp. Sci. St. Petersburg., vi., 1848, 83, 98. Type by subsequent designation (Ire. & Hull, Austr. Zool., iv., 1925, 76) *Chiton fascicularis* Linn.  
 1948. *Platysemus* Middendorff, Mem. Sci. Nat. Imp. Sci. St. Petersburg., vi., 1848, 83, 98. Type by subsequent designation (Ire. & Hull, Austr. Zool., iv., 1925, 76) *Chiton fascicularis* Linn.

1882. *Stectoplax* Dall, Proc. U.S. Nat. Mus., iv., 284, 288. Type by monotypy *Stectoplax porrecta* Cpr. (Japan).  
 1885. *Anisochiton* Fischer, Manuel de Conch., 881. Type by subsequent designation (Ire. & Hull, Austr. Zool., iv., 1925, 76) *Chiton fascicularis* Linn.

Shells small, elongate oval; sculpture of small pustules, dorsal area smooth or longitudinally striate; lateral and pleural areas scarcely differentiated; no radial ribbing on end valves; insertion plates and sutural laminae very large, continuous; anterior valve five-slit, rarely three, slits sometimes obsolete (this feature has not yet been observed in Neozelanic specimens); median valves one-slit on each side, slits sometimes missing (not in Neozelanic shells); posterior valve with two slits, sometimes obscurely inter-slit; girdle leathery, more or less covered with spicules of various degrees of thickness and length, but larger and prominent bunches at the sutures.

The Neozelanic species are not well differentiated at present, and we are tentatively allowing three species, although it may be that there are more, but until long series are collected from various localities, and different ecological conditions are studied, little good will accrue by haphazard description of shells as recently performed by Ashby.

An attempt to make a guide to the forms named results as follows:—

Dorsal area smooth . . . . .	<i>A. zelandicus</i> .
Dorsal area longitudinally grooved.	
Posterior valve small . . . . .	<i>A. thileni</i> si.
Posterior valve large . . . . .	<i>A. brookesi</i> .

This looks so simple that no confusion would appear possible, but when examples of "*zelandicus*" from various localities are compared many small differences can be observed, and their value depends on constancy in series.

## 27. ACANTHOCHITON ZELANDICUS.

### 27a. ACANTHOCHITON ZELANDICUS ZELANDICUS.

(Plate xvi., fig. 9.)

1835. *Chiton zelandicus* Quoy and Gaimard, Voy. de l'Astrol., iii., 400, pl. 73, figs. 5-8. French Pass, New Zealand (South Island).  
 1836. *Chiton zelandicus* Deshayes, Hist. Anim. s. Vert. (Lam.), 2nd ed., vii., 518.  
 1843. *Chitonellus zelandicus* Gray, Travels in N.Z. (Dieffenbach), ii., 246.  
 1847. *Chiton zelandicus* Reeve, Conch. Icon., iv., pl. xi., sp. and fig. 58.  
 1873. *Chitonellus zelandicus* Hutton, Cat. Marine Moll., 57.  
 1880. *Acanthochites zelandicus* Hutton, Man. N.Z. Moll., 117.  
 1883. *Acanthochites zelandicus* Hutton, Trans. N.Z. Inst., xv., 1882, 129, pl. xvi., fig. G. (dentition).  
 1893. *Acanthochites zelandicus* Pilsbry, Man. Conch., xv., 16, pl. 14, figs. 9-10.  
 1897. *Acanthochites zelandicus* Suter, Proc. Mal. Soc., ii., 192.  
 1904. *Acanthochites zelandicus* Hutton, Index Faunae N.Z., 86.  
 1904. *Acanthochites spiculosus astriger* Wissel, Zool. Jahrb. Abt. Syst., 20, 612. Error only.  
 1904. *Acanthochites bisulcatus* id., ib., p. 614.  
 1905. *Acanthochites zelandicus* Hamilton, Col. Mus., Bull. No. 1, 36.  
 1909. *Acanthochites bisulcatus* Suter, Nach. Blätt. Malak. Gesell., 2, 74. Correction of Wissel's error.  
 1913. *Acanthochites zelandicus* Suter, Man. N.Z. Moll., 26. Atlas: pl. 2, fig. 9, pl. 4, fig. 1.  
 1915. *Acanthochiton zelandicus* Iredale, Trans. N.Z. Inst., xlvii., 1914, 425.

1922. *Acanthochiton zelandicus* Ashby, Trans. Roy. Soc. South Australia, xvi., 579 (type examined?).  
 1924. *Acanthochiton zelandicus* Odhner, Vidensk. Medd. Dansk. Nat. Foren. Bd., 77 (N.Z. Moll.) 6. (Stewart Island).  
 1926. *Acanthochiton zelandicus* Ashby, Proc. Mal. Soc., xvii., ii., pl. i., figs. 1 a-c., pl. ii., fig. 5.

Shell small, elongate oval, little elevated, round backed, girdle leathery, with bunches of dense spicules at sutures.

Coloration varied, greenish of various shades, mottled and blotched with whitish; sometimes the dorsal area darker, bordered with white stripes.

Sculpture of round pustules with flattened slightly concave tops, closely packed but not touching; no demarcation at all between pleural and lateral areas; dorsal area triangular, smooth with transverse growth lines, but showing subcutaneous lining. Anterior valve with well rounded margin and showing no signs of radial waving; median valves deep in proportion to breadth; posterior valve with mucro elevated, submedian; posterior slope fairly straight.

Interior coloration pale bluish to greenish. Slitting 5—1—2.

Girdle leathery, covered with fine spicules and with bunches of long slender spicules at sutures; the coloration of these bunches varies from whitish to green and even red.

Dimensions: 19 x 9 mm. Dried figured specimen, but much larger specimens occur, especially when alive.

Habitat: New Zealand, south of North Island and north of South Island, perhaps more extensive.

Station: Between tide marks, under stones in rock pools, or on mud flats.

Remarks: The type locality is French Pass, in the north of South Island, and the figure shows that this is a smooth backed form. Iredale examined the presumed type some years ago, and noted it agreed with the general interpretation of the specimen.

27b. *ACANTHOCHITON ZELANDICUS HOOKERI*.

(Plate xvi., fig. 10.)

1843. *Acanthochaetes hookeri* Gray, Travels in New Zeal. (Dieffenbach) ii., 262. Inhab. New Zealand, Great Barrier Island, Bay of Islands.  
 1872. *Acanthochaetes hookeri* Hutton, Trans. N.Z. Inst., iv., 1871, 182.  
 1873. *Acanthochaetes hookeri* Hutton, Cat. Marine Moll. N.Z., 50.  
 1926. *Acanthochiton zelandicus doubtlessensis* Ashby, Proc. Mal. Soc., xvii., 12, pl. i., figs. 2 a-c., pl. ii., fig. 6, April 30. Doubtless Bay, North Island, New Zealand.

Ashby overlooked the description given by Gray, which reads: "Valves half ovate, covered with crowded flat-topped granules, grey and green striped; the central ridge olive, smoother. The interior (*sic*) valve evenly granulated, without any ridges. The mantles (*sic*) hirsute, the tufts of spines large and green. This species is most like *Acanthochaetes fasciculatus* of the English coast; it differs from *A. violaceus* in the size of the tuft, and the front valve not being rayed."

Ashby described his subspecies thus: "This form differs from *zelandicus* (*sic*) s.s., in the whole shell being much less raised; in the form of the median valves which are very flat and longitudinally short; in the sculpture, the granules being more elongate, definitely larger and more widely spaced; in the tail valve having the posterior slope, behind mucro, less vertical. *Measurements of Valves*.—Anterior valve, lat. 3.5 mm., long.

2.5 mm.; median valve, lat. 4.25 mm., long., 2.75 mm.; tail valve, lat. 3.5 mm.; long., 1.5 mm." Then followed measurements of paratypes with dimensions transposed!

Comparison of series from Auckland Harbour, Tauranga Island, indicates that the northern race of *zelandicus* has a tendency to elongation of the pustules, perhaps a little more depressed and the valves of less depth. The greatest value that can be given this form is subspecific.

27c. *ACANTHOCHITON ZELANDICUS AMPLIFICATUS* subsp. nov.

(Plate xvi., fig. 11.)

Many shells from the south of New Zealand and Stewart Island are very much larger, with distinct long teardrop pustules fairly crowded, and extreme specimens could easily be considered a distinct species. As many, however, show the pustules to be subcircular in youth, we here regard this southern shell as a subspecies only. The type specimen is a fine shell, collected by W. R. B. Oliver at Half Moon Bay, Stewart Island, under stones between tide marks. It is of the usual greenish colour with the dorsal area darker, the girdle very broad, the spicules well developed, the sutural tufts large and greenish, the spicules of delicate proportions. The lateral areas are indicated by slight waves.

Dimensions of dried specimen: 31 x 20 mm. Type in Dominion Museum.

28. *ACANTHOCHITON BROOKESI*.

1926. *Acanthochiton brookesi* Ashby, Proc. Mal. Soc., xvii., 14, pl. i., fig. 3 a-c., pl. ii., fig. 7. Locality unknown, probably Auckland Harbour.

We have not seen this species, but from Ashby's description here reproduced it appears to differ in the formation of the posterior valve, while the dorsal area is longitudinally deeply grooved. Although the locality was doubtful, Ashby hazards the suggestion that this species alone occurs in Auckland Harbour, an item we can at once deny, as we have numerous examples from this locality which do not agree with Ashby's description, which is as follows:—

"General Appearance: Dry and damaged specimen, elongate ovate, the tegmentum gradually increasing in width from the anterior valve to the sixth valve inclusive, the last two valves rapidly tapering; colour greyish-brown, mottled with dirty white; dorsal area raised, narrow, and strongly longitudinally grooved; sculpture consisting of small, flat, circular, closely packed granules.

"Anterior Valve: Anterior slope convex, apex slightly protruding, ray-folds not perceptible; sculpture similar to the latero-pleural areas of the median valves; insertion plate sloping forward, teeth sharp, but owing to damage not all slits present, no doubt five.

"Median Valve: Valve No. 4, dorsal area raised and arched, longitudinally convex, narrow, beaked; longitudinally deeply grooved. The latero-pleural areas are inseparable, side slope almost straight, decorated very evenly with more or less longitudinal rows of small, circular, flat granules, commencing very small near the dorsal area, and increasing in size anteriorly and laterally; sutural laminae well produced, but damaged; sinus between broad, slits 1—1; articulamentum pale greenish.

"Tail Valve: This valve is a good deal raised, dorsal area broader in proportion to the dorsal areas of the median valves, but similarly grooved; mucro postmedian, well defined; posterior slope at first very steep, then becoming more gradual; sculpture similar to the latero-pleural areas of the median valves. The sutural laminae are well produced and square-edged anteriorly, the sinus between broad; tegmentum of dorsal area overlapping.



slits 1—1, broad and short, ending in a circular pit which does not reach the tegmentum. The posterior portion of the insertion plate between the two slits is thickened and strongly and irregularly serrate-dentate, but while there is slight indication of fluting, there is no true slitting; articulum bluish-green.

"Measurements: Median valve, No. 4, lat., 5.5 mm.; long., 3 mm.; tail valve, lat., 4.2 mm.; long., 2.5 mm."

29. *ACANTHOCHITON THILENIUSI*.

(Plate xvi., fig. 19.)

1909. *Acanthochites thileniusi* Thiele, Zoologia (Chun), Heft 56, pt. i. (Revision Chitonon), 50, pl. vi., figs. 54-60. Tauranga, North Island, N.Z. Type in Nat. Hist. Mus., Berlin.  
 1910. *Acanthochites thileniusi* Iredale, Proc. Mal. Soc., ix., 155.  
 1913. *Acanthochites thileniusi* Suter, Man. N.Z. Moll., 1080 (description translated).  
 1915. *Acanthochites thileniusi* Iredale, Trans. N.Z. Inst., xlvii., 1914, 424.  
 1926. *Acanthochiton zealandicus thileniusi* Ashby, Proc. Mal. Soc., xvii., 13, pl. iv., figs. 5-7.

Suter gave a translation of Thiele's description as follows: "Valves whitish with a dark-olive longitudinal streak on each side of the central area, the lateral areas and the end valves mostly blackish-olive, now and again with whitish spots. Girdle with white and olive spicules. The valves are regularly arched. Jugal area longitudinally striated, the granules of the latero-pleural areas rounded, small, crowded. The tegmentum of the intermediate valves is considerably broader than long, in the proportion of 7-4; nearly straight anteriorly, the apex but little advancing behind; the sutural laminae are fairly broad, the sinus moderately broad. The anterior margin of the articulum of the head valve is descending. The tail valve has the tegmentum much broader than long (12-7), with the mucro slightly behind the middle and forming a blunt angle; articulum descending abruptly, the posterior margin slightly sinuated. Girdle broad, with short and thick calcareous spicules, the bristles of the sutural tufts also short and thick.

"Length: 18 mm.; breadth, 10.5 mm.

"Habitat: Tauranga (Dr. Thilenius).

Remarks: Thiele states that the species is very distinct from *A. zealandicus*, and nearest to *A. armatus* Pease from the Hawaiian Islands."

Ashby has claimed that no English translation appeared until he gave one in 1926, though the above had been printed in the standard book on New Zealand Mollusca some thirteen years previously, a statement which suggests he had not studied Neozelanic Loricata literature at all closely. When Iredale studied the so-called types of Rochebrune's *tristis*, said to have come from New Holland, he suggested that they might have been referable to this species, known to him only by Thiele's description. This has been rejected (correctly) as *tristis* has a smooth dorsal area, but *tristis* was not determined. The present species can be readily distinguished by the longitudinally grooved dorsal area, the thick calcareous sutural bristles, the circular pustules, and the small posterior valve.

30. *ACANTHOCHITON APPROXIMANS*.

(Plate xvi., figs. 12-18.)

1912. *Acanthochites approximans* Hedley and Hull, Proc. Linn. Soc. N.S.W., xxxvii., 276, pl. xii., figs. 5 a-f. Norfolk Island. Type in Australian Museum.

The original description reads: "Shell elongated, elevated, carinated. Colour pale yellow, flamed with dark to pale olive brown. Anterior valve densely sculptured with elongated pustules arranged in radiating rows. Posterior valve similarly sculptured, but pustules more separated and less regularly arranged; dorsal area similar to median valves; mucro sub-prominent, in front of the middle.

"Median valves; latero-pleural areas not differentiated, sculptured with irregular radiating rows of flattened pustules; dorsal areas broadly wedge-shaped, convex, longitudinally deeply striate, the striae crossed with growth lines.

"Girdle olivaceous, densely clothed with rather long spicules; sutural tufts large, silvery.

Interior white; sinus broad, shallow, minutely crenulate.

"Anterior valve having five and median valves 1—1 slits.

"Posterior valve with two slits separated by a posterior sinus.

"Length: 11 mm.; breadth, 4.5 mm.

"Station: On the underside of stones, or in the interstices of coral rock, in pools at low tide.

"Habitat: Lord Howe and Norfolk (type locality) Islands.

"Remarks: It closely resembles the Australian species, *A. granostriatus* Pilsbry, particularly in colour-pattern, but the grains on the Australian species are fewer and more prominent, and the head valve of the Island species lacks the incipient ribs of *A. granostriatus*."

#### EXPLANATION OF PLATE XVI.

Figures 1-11 and 19 were drawn by Miss Joyce K. Allan, and figures 12-18 by Miss Phyllis Clarke.

- Fig. 1. *Lorica haurakiensis* Mestayer, whole shell.
- " 2. *Terenochiton finlayi* Ashby, whole shell.
- " 3. *Terenochiton finlayi* Ashby anterior valve.
- " 4. *Terenochiton finlayi* Ashby, median valve.
- " 5. *Terenochiton finlayi* Ashby, posterior valve.
- " 6. *Parachiton subantarcticus* Iredale and Hull, elevation of valve.
- " 7. *Parachiton subantarcticus* Iredale and Hull, sculpture.
- " 8. *Cryptocoenchus porosus* Burrow, whole shell.
- " 9. *Acanthochiton zelandicus* Quoy and Gaimard, whole shell.
- " 10. *Acanthochiton zelandicus hookeri* Gray, whole shell.
- " 11. *Acanthochiton zelandicus amplificatus* Iredale and Hull, whole shell.
- " 12. *Acanthochiton approximans* Hedley and Hull, whole shell.
- " 13. *Acanthochiton approximans* Hedley and Hull, anterior valve, exterior.
- " 14. *Acanthochiton approximans* Hedley and Hull, median valve, exterior.
- " 15. *Acanthochiton approximans* Hedley and Hull, posterior valve, exterior.
- " 16. *Acanthochiton approximans* Hedley and Hull, anterior valve, interior.
- " 17. *Acanthochiton approximans* Hedley and Hull, median valve, interior.
- " 18. *Acanthochiton approximans* Hedley and Hull, posterior valve, interior.
- " 19. *Acanthochiton thileniusi* Thiele, whole shell.

NOTES ON STRIPED OPOSSUMS OF THE GENUS *DACTYLOPSILA*.

(By ELLIS LE G. TROUGHTON.

*(By Permission of the Trustees of the Australian Museum.)*

As though conscious of being the most spectacularly coloured members of the Family Phalangeridae, if not of all marsupials, the Striped Opossums are of shy nocturnal habits so that comprehensive series from one area are rarely obtained as a check upon their striking colour variation, which has led to the description of several quite unnecessary forms.

*Habits.*—Though little is known of the life history of this interesting genus, it may prove useful to assemble the data supplied by various authors. According to Wallace the Striped Opossum of the Aru Islands lives on fruit, but there, as in New Guinea and Australia, the animal is probably also insectivorous and meliphagous, as indicated below.

When defining the closely allied genus, *Dactylonax*, Thomas pointed out that the ends of the upper incisors are worn off abruptly by friction, "not with the lower incisors, which touch them in quite a different part, but with some outside objects, such as tree trunks or boughs." Also that the animal "has become specialised in a closely similar way to what has taken place in the Aye-Aye (*Daubetonia*), a single finger lengthened and made slender (presumably for searching for grubs in wood), combined with powerful rodent-like incisors for gnawing the grubs out when found."

The fourth finger in *Dactylopsila* is also disproportionately, though not so remarkably lengthened, while specimens from Papua and Queensland show the same wearing away of the extreme points of the upper incisors. The accuracy of Thomas' assumption regarding feeding habits, as applied to *Dactylopsila* also, is supported by the following notes:—

Quoting the observations of Dr. Carl Lumholtz, Collett wrote, in 1887: "It is called 'Nolloa' by the natives, and is supposed to feed partly on wild honey"; only one specimen was seen. In 1916, Lönnberg recorded these notes from the collector's diary of Dr. Eric Mjöberg, regarding two specimens taken in the rain forest at Millaa-Millaa, Queensland: "Caecum small, the ventricle filled with half digested remains of larvae of *Lepidoptera* and *Diptera*, etc. The animal scratches out such larvae from cracks in the wood by means of its fourth elongated finger. It makes a nest of dry leaves in hollow trees. It hunts with great eagerness for the nests of the small stingless bees of the genus *Trigona*, partly for the sake of the insects themselves, and partly for the sake of the honey." The aborigines said that the first specimen obtained by him was the only one observed for a long time.

According to the late Mr. Robert Grant, for many years Taxidermist to the Australian Museum, who collected two specimens in the Atherton district of Queensland, the remains of berries and leaves were found in their stomachs. Assisted by four blacks, he says: "One was searching among the elk-horn and orchids when he suddenly called out 'Tamin.' On being roused from their slumber, the tamin were a bit dazed, but it was not long before they were scampering nimbly amongst the branches. We were going to shoot them, but the blacks called out that they would catch them alive, which they did."

Of the Mount Lamington specimens, Mr. C. T. McNamara wrote that they were frugivorous, nocturnal, arboreal, and fairly plentiful, though difficult to obtain owing to their habits. According to Le Souef, a Striped Opossum, kept in Taronga Park, lived well on a variety of food, including condensed milk, biscuits, fruits, and lettuce. It was quiet and inoffensive, and very active at night.

Native names given appear to vary considerably, according to districts, and possibly the interpretation of the recorder. The aboriginal name in the Atherton district is given as "Tamin" by the late Mr. Grant, while another specimen from Queensland is labelled "Teeman," and "Nolloa" is given by Collett for the Herbert River district. For the Striped Opossums of the Mount Lamington area, Northern Division of Papua, Mr. C. T. McNamara supplies the name "Hombu" from the Orakaiva dialect. The specimen from the Fife Bay district, on the opposite coast of Papua, is labelled with the native name "Hudu."

*History of the Genus.*—Gray founded his genus and species, *Dactylopsila trivirgata* (P.Z.S., 1858, 111, pl. lxiii.) upon a single female collected on Aru Island by A. R. Wallace, and later extended its range to Australia (P.Z.S., 1866, 220) on two specimens collected at Port Albany, Cape York Peninsula, by Charles Coxen. In 1875 Peters and Doria (Ann. Mus. Genov., vii., 542) described *D. albertisi* from Sorong, New Guinea, regarded as identical with *trivirgata* by Thomas, and later (Ann. Mus. Genov., xvi., 1881, 673) recorded the latter from the Island of Waigeu, N.W. New Guinea. Ramsay, in 1876 (Ann. Mag. Nat. Hist. (4), xvii., 441) had added to what he then regarded as the "already very extensive range of *D. trivirgata*" by recording a specimen from the Herbert River, near Rockingham Bay, Queensland, about 550 miles south of Port Albany, from which area Collett later recorded one.

In his remarkable Catalogue of 1888, Thomas listed the original species only, and in the same year Milne-Edwards described a new form from the Aroa River, southern New Guinea, as *D. palpator*. After a renewed examination of the British Museum material in 1908, Thomas (Ann. Mag. Nat. Hist. (8), i., 122) decided that the specimens hitherto referred to *trivirgata* could be "readily separated into three species by the coloration of the hands and feet," namely, the wholly white-footed *trivirgata* of N.W. New Guinea and neighbouring islands, the black-footed form of S.E. New Guinea, for which he proposed the name *melampus*, and the partially dark-footed Queensland form which he named *picata*. In this paper Thomas separated *D. palpator* as representing a distinct genus, *Dactylonax* (Ann. Mag. Nat. Hist. (8), vi., 1910, 610) characterised by its proportionately much longer fourth finger, and cranial and dental characters.

Since 1910 no less than five forms have been described, mainly from single specimens, including *D. hindenburgi* Ramme (Sitz. Ges. Nat. Freunde Berlin, 1914, 9, p. 413, pl. x.), and *occidentalis*, *arfakensis*, *biedermanni*, and *kataui*, all described by Matschie in 1916 (Mitt. Zool. Mus. Berlin, viii., 2, 302-6).

Finally, in 1922, Thomas (Nova Guinea, xiii., 5, 734) on reviewing the whole series available, amounting to 24 specimens from various localities, stated that it seemed impossible to sort them locally by the details of their markings, in which specimens from identical places differed widely. After expressing the opinion that the use of such characters as employed by Dr. Matschie was entirely fallacious, Thomas wrote that he was now doubtful whether even *D. melampus* should be specifically distinguished from *trivirgata*, but decided "for the present the black-footed forms may provisionally be kept distinct from the white-footed."

In response to inquiries, Dr. Ernst Schwarz, Research Fellow at the Berlin Museum, kindly sent very helpful information concerning specimens in that Museum, almost every one of which he says has been made the type of a "species." In one type, he points out, the hands and feet are white, but in three additional specimens from the same place they are black, also saying: "The same variation occurs in skins from N.W. New



Guinea, but the majority of the New Guinea specimens has the hands and feet black." These remarks would appear to confirm the doubt expressed by Thomas as to the distinction of the white and black-footed forms, were it not that a series of 14 specimens in the Australian Museum collection, 12 of which are from the same district, are consistent in having the manus and pes without white markings and the chin-spot undivided, suggesting that there exists a distinct black-footed form at least for S.E. New Guinea, thus confirming Thomas' provisional separation of *melampus* from *trivirgata*.

Unlike the Australian Museum series of *melampus*, the available material of the Queensland species, *D. picata*, shows extraordinary variability in the very characters so consistent in the former series. The comparative consistency of the *melampus* series at first suggested that the variability of Queensland specimens was indicative of a second species, but careful examination shows that there is a complete intergradation of variation independently of sex and locality.

As Dr. Schwarz recently examined the Berlin Museum material and may publish some notes upon it, the following will deal only with the variation shown by the local form, and the status of *D. biedermanni* as affected by the series of *melampus* in the Australian Museum.

#### DACTYLOPSILA MELAMPUS Thomas.

*Dactylopsila melampus* Thomas, Ann. Mag. Nat. Hist. (8), 1, 1908, p. 122.

*Dactylopsila biedermanni* Matschie, Mitt. Zool. Mus. Berlin, viii., 1916, p. 303.

*Specimens examined*.—Amongst the fine collection of mammals received by the Trustees from Mr. C. T. McNamara, Inspector of Native Plantations in the Northern Division of Papua, are nine *D. melampus* from the Mount Lamington district. This fine series comprises one adult male, six adult females, two of which have two pouch embryos each, and two immature females. Also in the Museum collection is an adult male and two females from the Mambare River, practically topotypical of the species, which were collected by C. Richart. An adult female from Fife Bay, Papua, comes within the range of variation exhibited by the other material.

*Variation*.—All the above specimens have the chin-spot large, well defined and complete, only one specimen having the very slightest indication of the white hairs intruding upon the black area of the spot. The manus and pes are consistently blackish-brown or black, the hairs being comparatively short and sparse.

The cheek-spot and lateral stripe, however, are extremely variable; in one specimen the cheeks are quite black and embrace the lateral stripes; in others the broadening downwards of the lateral stripe isolates the light cheek-spot, in the manner regarded as typical of *biedermanni* by Matschie, while another has no trace of the lateral stripe, so that the pale cheek-colour is continuous with that of the neck. The white tipping of the tail occurs quite independently of sex; in the Mount Lamington series the adult male and two females have the tail terminating with its black coloration, while six females have the white tip. In the Mambare River specimens, the male has the white and the females the black tail-tip. The length of the tail, considered of importance by Matschie, is extremely variable, measurements of the spirit material from Mount Lamington showing a male to have the tail only 37 mm. longer than the head and body, while in three females it is 70-72 mm. longer, and in one female actually 110 mm. longer than the head and body.

*Status of D. biedermanni*.—Matschie based his species upon a single

specimen, stating that it was similar to *melampus*, but differed firstly in having pale cheeks standing out clearly owing to their being bounded by a black band between the ear and the chin, which was "only in the centre strongly mixed with yellow"; secondly, he said it differed in the tail being more than 100 mm. longer than the rest of the entire body, and thirdly, in having a smaller skull. Critical examination of specimens of *melampus* in comparison with Matschie's description shows the above distinctions to be within the range of proved variation, as shown below, particularly in regard to the length of the tail.

After stating in his description of *melampus* that there was a certain amount of variation in the detail of colour-pattern in all members of the genus, Thomas described the cheeks as either *white in continuation of the belly colour*, or black, owing to the broadening downwards of the lateral dark facial stripe. Matschie describes this broadening downwards of the facial stripe as strongly mixed with yellow in the centre, presumably of its length, which actually implies that the yellowish white of the belly-colour extends through the stripe onto the cheeks. It therefore appears that the difference cited by Matschie exists only in the two authors' methods of describing individual variation. The apparently greater tail-length of *biedermanni* is entirely due to Matschie's having subtracted the head-body length from a tail-length which included the longest hairs, and comparing the result with Thomas' dimensions, in which the hair-length was not included. As Matschie's dimensions show the hairs on the tail-tip to represent a difference of 50 mm., it is clear that the tail difference is not maintained; this conclusion is supported by the fact that deduction of the head and body-length from the tail-length without the hairs of the female holotype of *biedermanni* exceeds the head and body by only 70 mm., which is in agreement with that of 71-72 mm. in two females from Mount Lamington, of the eastern coastal region, measured as complete spirit specimens.

Matschie's third character, the smaller skull, is nullified by the fact that the basal skull-length of his holotype is 3.8 mm. shorter than that of the type of *melampus*, naturally implying that all dimensions would be smaller; the greatest breadth of the former skull is 5.8 less, which should be within the scope of natural variation, as it is only 2 mm. in excess of the difference between the respective basal lengths of the two type skulls. Finally, in the "smaller" skull of *biedermanni* the length of molars 1-3, usually regarded as a most reliable cranial feature, is only two-tenths of a millimetre less than that of the type of *melampus*.

*Distribution.*—Thomas had specimens from a comparatively wide range, from Tamata in the eastern part of the Northern Division to the Angabunga or St. Josephs River on the western side of Central Papua. It is evident from Matschie's note on the geographical range of the two forms (*loc. cit.*, 303) that he attributed the variation noted by Thomas in his series of *melampus* to that author having reviewed material of too wide a range, and thus representative of more than one form, instead of accepting the more natural conclusion of individual variation, arrived at by Thomas in studying his series. However, examination of three specimens from the Mambare River, and nine from the Mount Lamington district, within about thirty-five miles of the type locality, shows them to vary considerably within the individuals from each locality, especially with regard to the isolation or otherwise of the light cheek-spot.

When it is considered that the type locality of *melampus* is barely 60 miles from the mouth of the Aroa River, from the top or upper region of which the type of *biedermanni* was secured, and that the Angabunga River rises within a few miles of the Albert Edward Range, from both of which

localities Thomas identified specimens of his species, one cannot agree with Matschie in regarding the intervening two to five thousand metre mountain range as an insuperable barrier to the spread of *melampus* from coast to coast. It may be noted that the Angabunga rises somewhat north of the Albert Edward Range, and that a stream north of the Mambare also rises to the northward of that Range, suggesting an avenue for the spread of the species, quite apart from many others which may have been provided elsewhere by lower altitudes in the mountain chain.

In view of the above analysis of characters regarded as diagnostic by Matschie, the range of variation noted by Thomas and exhibited by Australian Museum material, and the even greater area of distribution of the single extremely variable Queensland species, I have no hesitation in regarding *D. biedermani* as synonymous with *D. melampus*.

DACTYLOPSILA PICTATA Thomas.

*Dactylopsila trivirgata* (part) Gray, Proc. Zool. Soc., 1866, p. 220; *Id.*, Ramsay, Ann. Mag. Nat. Hist. (4), xvii, p. 331; *Id.*, Collett, Zool. Jahrb., Syst., ii., 1887, p. 932.

*Dactylopsila pictata* Thomas, Ann. Mag. Nat. Hist. (8), i., 1908, p. 123; *Id.*, Lönnberg, Kungl. Sv. Vet. Handl., lii., 2, 1916, p. 9.

*Specimens examined*.—A series of twelve, of which the sex of nine can be determined with certainty, from the northern end of Cape York to Clump Point, near Townsville, Queensland, providing the southernmost record of the genus. The value of the series for the purpose of comparison was greatly enhanced by the loan of several specimens from the Melbourne and Adelaide Museums.

*Colour variation*.—In view of the consistency of certain markings in *melampus*, a preliminary examination of the Queensland material suggested the existence of a northern species with a small, undivided chin-spot, and a more southern form with a large divided spot. Closer analysis, however, shows that there is a remarkable range of variation which is most marked, strangely enough, in the very features found consistent in *melampus*. In the latter the chin-spot is consistently complete, irrespective of age or sex, and the paws uniformly black or brownish-black, while in the Queensland series these features exhibit a bewildering intergradation, apparently independent of age, sex, or locality.

So far as one can discover, the males have the chin-spot clearly divided into two, though a very doubtful male from the Cape York Peninsula has the spot complete. All four identifiable males have divided chin-spots, and are from localities south of Cairns, while in seven females from the Cairns and Cardwell districts, four have complete chin-spots, as in the type female, and three have the spot divided as definitely as in the males. Furthermore, the late Mr. Oldfield Thomas informed me that the British Museum possesses a female from the Barron River with a divided chin-spot; there is also a Cape York specimen of doubtful sex exhibited in the National Museum, Melbourne, which has the spot divided. The foregoing would seem to indicate that, as the character of the chin-spot varies in females from the one area, additional males would exhibit similar variation, thus rendering the feature of no diagnostic value locally.

Coloration of the manus and pes is similarly variable in some specimens, differing completely from Thomas' original description; the skin of a doubtful male from Cape York has the upper surface of the paws completely black as in *melampus*, as also has a female from the Herberton district, both lacking any trace of the white markings described by Thomas. On the contrary, several males and females have the paws completely white,



without any trace of the continuation of the dark limb band onto the *manus* and *pes*, as described for *picata*.

The marking on the cheeks appears to be quite as variable as in *melampus*; in most specimens the light colour of the neck continues onto the cheek, but in some there is a tendency for the lateral stripe to extend downwards, while in one male from Cardwell an extension of the lateral stripe joins the corner of the chin-spot, isolating a light cheek-spot in a manner regarded by Matschie as typical of *biedermanni*. The tail-tip is white in all the males examined, but may be black in females from the same locality, five females having white and two black-tipped tails.

*Cranial variation*.—Detailed measurements of six skulls, including one from Cape York, show a general uniformity quite out of keeping with the variability of coloration. The length of molars 1-3 ranges from 9.3 to 10.2 mm., and measures 9.5 and 10.2 respectively in a male and female from the same locality. The general appearance of the nasalia is somewhat variable, but, as Thomas pointed out in a letter, when stating that the nasals of his Cape York and Barron River females were about the same: "These nasal shapes are attractive and suggestive as systematic characters, but seldom prove really consistent. I have often been disappointed in using them."

*Localities*.—Specimens in the Australian Museum are from the Somerset area, and junction of the Holroyd and Kendall Rivers, Cape York; Russell River, near Cairns; Herberton district; Abergourie and the Tully River, Cardwell district; and Clump Point, near Townsville, which is the southernmost record.

Specimens lent by the National Museum, Melbourne, include a skull from Cape York and a male and female from Lake Eacham, near Yungaburra, Cairns district. One of the South Australian Museum specimens is labelled Herberton district, and the other two North Queensland.

*Conclusion and Acknowledgments*.—The remarkably variable colour-marking of the Queensland species would appear to confirm Thomas' doubt as to the ultimate distinction of the black and the white-footed forms, were it not that the series of *melampus*, as already shown, is strikingly consistent in the very features which are so variable in the local form over a very wide area. The range of variation certainly establishes the fallacy of Matschie's method of describing variable creatures from single specimens, often from within a smaller range of localities than given above for *picata*; doubtless that author would have been tempted to describe several species from the material available, which I consider to represent but a single very variable form. It is with a view to assisting in the reduction of the several puzzling and very doubtful New Guinea forms that the notes upon colour variation have been submitted in considerable detail.

My best thanks are proffered as a tribute to the memory of the late M. R. Oldfield Thomas, F.R.S., whose help has been so readily afforded me during the past ten years, and whose loss is keenly felt as that of a kindly and encouraging correspondent. I am also indebted to Dr. Ernst Schwarz, Research Fellow at the Berlin Museum, for securing me copies of relevant papers and generously supplying data concerning Matschie's types, upon which it is hoped he will publish notes in the near future. Sincere thanks are also due to Mr. J. A. Kershaw, Director of the National Museum, Melbourne, and Professor T. Harvey Johnston, D.Sc., Honorary Museum Director of the South Australian Museum, for their very ready response to an appeal for loan material, in which all save gallery specimens were forwarded for examination; also to my colleague, Mr. J. R. Kinghorn, C.M.Z.S., who kindly made notes and sketches of gallery specimens while engaged upon research in Melbourne.



## SOME NOTABLE NAME CHANGES.

By TOM IREDALE.

Recently checking back generic names I came across a couple of my own errors that I have not seen otherwise corrected so here purpose emendation. It is most unfortunate for the workers at this side of the world that those better situated do not give any assistance, but rather, hindrance. The Indices of the Zoological Record have not been collated for nearly twenty years, and it is very easy to make a slip while consulting over twenty volumes for each name. While doing such work any interruption may dislocate the continuity, and it seems due to such causes that errors are made.

I wish here to introduce two personal names in connection with groups as a matter of urgency. It is still considered an honour to have one's name associated with some member of the group one is interested in, and, due to delay, I have known of one or two tragedies, e.g., a famous ornithologist was almost disgusted to find his name utilised for a parasitical worm. Therefore I now propose

## CAYLEYNA

in honour of my friend, Mr. N. W. Cayley, for the beautiful finch known as *Emblema picta*, so named by Gould. There are other "Caleys" in the field, and as far as I have traced the name has not yet been utilised. When Gould introduced (*Birds Austr.*, pt. vii., June, 1842) his generic name, he was unaware that there was any prior use, but it has long been known that Rafinesque had proposed *Amblema*. I noted that Deshayes, in 1840 (*Dict. Univ. d'Hist. Nat. (Orbigny)*, Vol. I., p. 334) proposed *Emblema* as a better spelling than *Amblema*, and this unfortunately invalidates Gould's name.

The second case is the proposal of

## MACNEILLENA

in honour of my colleague, Mr. F. A. McNeill, for the crustacean group known by the name of *Trichia* de Haan. Mr. McNeill is publishing an account of this interesting group and, showing me his MSS., I recognised an old molluscan friend in his genus name. Though not yet recognised by carcinologists, the molluscan *Trichia* has undoubted priority over the crustacean introduction, and as there is no substitute I am introducing the above name. The definite chronology of the two generic names reads

*Trichia* Hartmann, *Erd. u. Süßwasser Gasterop.*, p. 41, 1840, a genus of Terrestrial Mollusca.

*Trichia* de Haan, *Fauna Japonica* (Siebold), Vol. V., p. 109, 1841, the genus of Crustacea above renamed.

Now to my own two mistakes. In selecting *Obrussa* (*Rec. Austr. Mus.*, xiv., 1925, 269) for a beautiful little shell, I overlooked that Braun (*Canadian Entomologist*, xlvii., 1925, 196) had appropriated it for a Microlepidopterous genus. I now introduce *Obrussena* as substitute, and would note that though my genus suggests *Kleinella*, comparison of specimens regarded as referable to that genus indicates that the resemblance is superficial. I will deal with this later.

I also introduced *Stipator* as a genus name for *Teinostoma starkeyae* Hedley, and I find that this name is also invalid. I therefore propose *Starkeyna* as a novel name for this group. My *Stipator* appeared in 1924 (*Proc. Linn. Soc. N.S.W.*, vol. xlix., 182), and the prior *Stipator* in 1900 (Rehn, *Tr. Amer. Ent. Soc.*, vol. xxvii., 90) for a genus of LOCUSTIDAE.

## OBITUARY.

ARCHIBALD JAMES CAMPBELL, C.M.B.O.U., C.F.A.O.U.

LEACH, JOHN ARTHUR, D.Sc., C.M.B.O.U., C.F.A.O.U.

## THE PASSING OF CAMPBELL AND LEACH.

By TOM IREDALE.

Nearly fifty years ago there was begun in the Southern Science Record a series of articles on the Nests and Eggs of Australian Birds by A. J. Campbell. From this modest beginning developed the well known two volume work with the same title published some twenty years later. Thirty years have elapsed and none has yet taken its place, and from that sentence can be gauged the complete success of the undertaking. During the compilation of this work Campbell met with many other egg collectors and made many friends. The initiative was taken by himself when he invited all to a dinner where matters of interest common to all could be personally discussed. Some twenty met on August 15, 1896, and this date we can assign as the starting point of the present day wonderful band of Australian ornithologists. Though the centre of interest has recently changed from Melbourne to Sydney, Melbourne, led by A. J. Campbell, undoubtedly blazed the track which culminated four years later in the formation of the Australian Ornithologists' Union, a body which is to-day virile and active and one of the leading bird Societies of the world. At the meeting which saw the formation of the Union, Campbell was selected as Editor of a publication to be called the "Emu," and this new venture he successfully floated, and when later he withdrew from active editorship he was always ready in an emergency to carry the work along when circumstances necessitated such measures. Thus it may be laid to his credit that the "Union" and the "Emu" made such an auspicious beginning, and this was indicated last year when he was invited to undertake the duties of President for another term after so many years' active service in the cause of Australian ornithology. No one has given a longer life to the science of ornithology in Australia, and, though at first essentially an egg collector, later he became interested in the birds themselves, but never with the same enthusiasm as he had given to the eggs. No comparison can be made, as others who have been interested in eggs and birds have never clashed in their studies with Campbell's work. In later years his collection was handed over to the National Museum, Melbourne, where it is now housed along with the H. L. White Collection.

Campbell's work for Australian ornithology can be summed up in "Fifty years' active service," and that means more than most can realise.

Ten years after Campbell's *magnum opus* appeared, a little work entitled, An Australian Bird Book, was issued also at Melbourne. Modest as was Campbell's first effort, this inconspicuous little book nearly surpassed his for lack of pretence. Without warning and with little acclaim the new work was published at the price of 3/6, and none, certainly, least of all its author, J. A. Leach, anticipated the part it had to play in Australian ornithology. A first edition of 2/3,000 was printed, and immediately sold out, thousands followed with remarkable rapidity, and it has continued on sale year after year and in twice revised editions until somewhere about 30,000 have been circulated throughout Australia.

Scarcely a field ornithologist, Leach's vision made a niche in his country's ornithological history, almost as important as that of Campbell. Certainly while the latter had provided a more important work in every way, the former achieved a much larger reading public. Leach also became Editor of the "Emu," and these two, Campbell and Leach, may be said to have been the supports of Australian ornithology for the past generation.

It is a remarkable coincidence that both should have passed over within such a short time of each other, as Leach was much the younger man.

It is somewhat difficult to appraise exactly the part of each at this time, as their failings are better known than will later be the case, when only their absolute work will be calculated. Whatever the ultimate result it cannot change the fact that these two have carried the Australian Ornithologists' Union from its beginning to the present time, and that achievement is one unparalleled in the history of ornithological science throughout the world. The journal throughout all the time has been welcomed everywhere on account of its brightness and the quality of the contributions, and has been favorably contrasted with the two older journals, the "Ibis" and the "Auk," the media of the British and American Ornithologists' Unions respectively.

At this present moment, through the passing of such a notable pair, Victorian ornithology does not compare as well as heretofore with our own, but with the examples of Campbell and Leach there can be no doubt that this dimmer lustre is but a passing phase, and that soon we shall see some notable successors following the path blazed so surely.

It would be hypercriticism to deal with the demerits of the work of either as the enthusiasm of each demands the highest appreciation, and their great continuity of work, each in harness to the very end, furnishes their best epitaph.

A mere list of their scientific papers would mean little, as, long as it would be, their work as editors meant more to the advancement of Australian ornithology than their personal publications. Their published works stand as worthy monuments, as each is a classic in the strictest sense of that word. As long as Australian ornithology lasts, so will the names of Campbell and Leach be honoured, and the only regret is that the latter did not enjoy the leisure he anticipated and which he had already planned to devote to Australian ornithological service.

Such great leaders are scarce in every branch of science, and it can be asserted that both led more by example than by precept, doing and thereby inciting assistance from others. It is not easy to suggest their Victorian successors, but Campbell's son is one of our foremost ornithologists, and we can look forward to the name of Campbell still extant in our records for many years. It is to be hoped that many years will pass before we have to chronicle the death of any other of our notable workers, as the record of these two at one time is a severe blow. It seems unnecessary to chronicle the honours that fell to these two, and it is probably well known that in addition to being President of the Union, each was honoured by the British and American Ornithologists' Union with the highest honours at their bestowal. It is pleasing to note that our great regard was thus manifested by these and other great Unions, and that our high esteem was, in their opinion, well merited.

As a suitable epitaph may be appended, the well known one

"They will always live by their works."



## THE LATE ARCHIBALD JAMES CAMPBELL.

On September 11 of the present year, there passed on a very great ornithologist, namely, Archibald James Campbell, whom the writer of this had known for nearly fifty years. Big of frame and bone, tall, somewhat lean, but suggesting energy and tireless activity, small, shrewd eyes looking out from under very bushy brows, with a decidedly humorous twinkle (or was it cynicism?) head, covered with a thick crop of stiff hair, face well covered with moustache and beard, dressed always in rough surfaced tweed such as Scotchmen love.

Such was A. J. Campbell as I remember him, when I was introduced to him at a meeting of the Field Naturalists' Club of Victoria.

Looking back to that time reminds me of the fact that we boys looked upon Mr. Campbell as a sort of wonder-man, who, for his intense love of ornithology, went into the most wild and outlandish places in Australia like an explorer, which, indeed, he was, in a sense.

No thought of a rough time ever scared him, no journey was too long or too arduous. In connection with this I need only mention one trip as an example, that to the virgin scrub of the Richmond River, N.S.W., in the days when this dense semi-tropical region was not yet opened up, nor settled as it is to-day. Forty years have altered all that.

To tramp in the country with A. J. Campbell meant a very strenuous time. With a long swinging stride and a tireless energy which would permit of scarcely any rest his keen eyesight, and an uncanny, almost instinctive faculty of where to look for a nest, all made for a pleasantly tiring day.

In my boyhood, when I first met him, we were only just starting to collect "clutches" of eggs as distinct from dividing the spoil between two or three, the rule being that the finder of the nest had first choice, and so on.

On one occasion I found the nest with eggs (3) of the rufous Whistler (*Pachycephala rufiventris*) and intended leaving the eggs. Not knowing this, Campbell offered me an exchange for my two out of the find. He recognised our unwritten law, and with strict justice was obeying it. I let him have the whole clutch—gratis.

I merely mention this as an instance of his perhaps Scottish keenness in "swopping." This keenness was very characteristic of his dealings in all his egg exchanges.

In those days there were not half a dozen known bird and egg collectors in and around Melbourne at least, and a little later we used to eagerly await the appearance in "The Australasian" of "Some Australian Birds," which he contributed weekly. These very interesting illustrated articles undoubtedly stirred up great interest in the study, and were of very great use to those who could not gain access to our only work of reference, Gould, at the Public Library. Later on these articles were embodied in his fine book, "Nests and Eggs of Australian Birds," a monument that will always stand as to his efforts as a pioneer in Australian ornithology.

To A. J. Campbell the idea of an Australian Ornithologists' Union was due. Later the Union was permitted to add the term "Royal" to its title, and there can be no doubt as to the benefit to ornithology accruing from the formation of such a Society.

Having seen the Union of which he was the genesis become such a success, and also reach its majority must have been a source of great pleasure to him during his life.

One outstanding characteristic of A. J. Campbell was the fact that, desirous as he was to acquire as complete a collection as it was possible to



obtain, both by his own exertions and those of others, he was never a mere "cabinet" collector.

He was an intense lover of all Nature. Not sufficient alone for him was the pleasure of finding a new specimen to add to his store. He revelled in the beautiful surroundings in which the species were found. He loved particularly the moist fern—embowered gullies of his native State. Sunset, foliage, especially trees, water, all the colour and light and shade of our country, were intensely appreciated by him.

All through his book this fact continuously crops up, and with the religious conviction of his Scotch forebears he frequently gives praise to the divinity for the beauty of Nature.

Later on in his declining years, he devoted much of his time to his favourite tree, the Wattle, of which he made many fine studies, and was a great advocate of the Wattle Day Movement.

Such was A. J. Campbell, the bird-man, Nature-lover, author. A man with an ideal and singleness of purpose which he held on to till the end of a long life. To quote from the preface of his book: "My fixed aim was towards a more complete and permanent work" (after his hand-book). "By the light of future research, shortcomings, no doubt will be discovered here and there in the book—no human work was yet perfect—but the author ventures to hope that the sympathetic verdict of students and readers will be: 'How few are the mistakes,' while his earnest desire is that the work may remain good long after his death, yea, and the deaths of those who love him."

He concluded: "My doxology. No work should be complete without praise to God, and perhaps no natural history work such as I am now closing and in the execution of which the lines have fallen to me in so many pleasant places."

"O Lord, how manifold are Thy works; in wisdom Hast Thou made them all. The earth is full of Thy riches."

E. A. D'OMBRAIN.

#### LEATHERJACKET GENERA.

By G. P. WHITLEY.

The fishes of the family ALUTERIDAE, commonly known as Leather-jackets, may be divided into several new generic groups as set forth hereunder as a preliminary to revision. A list of the Australian species has been given in Austr. Mus. Mem., v., 3, November, 1929, 414-423.

*EUBALICHTHYS*, nov. Orthotype, *Monacanthus mosaicus* Ramsay & Ogilby, 1886.

Pelvic spine small or obsolete. No ventral flap. No bristles on caudal peduncle. Depth more than one-half length to hypural.

*NELUS*, nov. Orthotype, *Monacanthus vittatus* Richardson, 1846.

Fins angulate. Skin with spaced papilla-like denticles. Depth less than length of head. The New South Wales species generally called "*Cantherines ayraudi*" by authors is now *Nelus vittatus*. *Nelus ayraud* (Quoy & Gaimard) is West Australian and apparently not conspecific.

*NAVODON*, nov. Orthotype, *Balistes australis* Donovan, 1824.

Dorsal and anal fins not angulate, with more than thirty rays in each. A small immovable ventral spine. Depth more than length of head or less than one-half length to hypural. *Navodon* also accommodates *Monacanthus setosus* Waite, 1899.

*LAPUTA*, nov. Orthotype, *Monacanthus knerii* Steindachner, 1867.

Substitute name for *Paramonacanthus* Steindachner (Sitzb. Akad. Wiss. Wien, lv., 1867, 561) not Bleeker (Ned. Tijdschr. Dierk., iii., 1866, 12).

## ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES.

*New Members.*

The following new members have been elected since the publication of the last list (August 13, 1929):—

**Ordinary Members.**—W. Boardman (previously associate), Noel Burnet, Capt. J. Crossley, J. C. Eldridge, M.H.R., Mrs. E. M. Jones, A. E. Jobson, K. C. McKeown (previously associate), G. G. Park, Mrs. A. Rowling.

**Associate Members.**—Mrs. Abbott, Mrs. W. I. Arnott, A. De Lestang, E. V. Dix, R. Emerson, Miss E. Gray, Rev. P. Hubbard, W. C. Johnston, S. L. Larnach, A. J. Marshall, Miss D. Middleton, Miss E. M. Swain, Mrs. Grafton Smith, Miss Helen Sheridan, H. G. Sundstrom, H. G. Stanger, Capt. Toovey, Mrs. R. C. Tobin.

**Honorary Associate Member.**—Upon the nomination of the Entomological Section, Mr. F. P. Dodd, of Kuranda, Queensland, was elected an Honorary Associate member, in recognition of his valuable services to Australian entomology.

*Jubilee Fund.*

Under the able management of the Women's Auxiliary, with Mrs. Norman Lowe as president and principal worker, a successful function was held at David Jones, Ltd., on the 9th October. Zoological talks, illustrated by the newly-acquired epidiascope, were provided in the Auditorium, and a dance followed in the Ballroom. A cheque for the net proceeds amounting to £105 was handed to the president, Mr. Anthony Musgrave, by Miss Hume-Barbour, Associate Benefactor of the Society, who launched the Women's Auxiliary in the first instance.

Further contributions to the Handbook Publication Fund received since the previous list was published, are as follows:—J. Russell, £1; K. A. Hindwood, 10/6. Included in Women's Auxiliary function:—Mesdames Bryce and Mesmer, £6/10/-; David Jones, Ltd., £5/5/-; Miss Sulman, £3; Sir Allen Taylor, W. H. Cornford and S. C. Burnell, £2/2/- each; Miss Macarthur Onslow, Mrs. Mackay, Miss Kelso King, G. R. Williams, J. T. Lingen, Aubrey Halloran, J. Thomas, Judge Thomson, L. A. Curtis, C. A. White, and T. B. Simpson, £1/10/- each; Mrs. Archdale Parkhill and D. Todd, £1/1/- each; Dame Eadith Walker, £1; E. J. Young, 15/-; Sir Arthur Cocks, Mrs. G. Earp, J. Powell, 10/6 each; Mrs. Syd. Dickson, 10/-. The fund now stands at £727.

*Notes About Members.*

Dr. G. A. Waterhouse has relinquished his position on the staff of the Council for Scientific and Industrial Research. Dr. A. J. Nicholson has been appointed assistant chief of the Division of Economic Entomology, Canberra.

*The Epidiascope.*

A Leitz Epidiascope has been purchased by the Society for use at sectional meetings and lectures. Projecting on the screen an enlarged image (to 6 x 6 feet) of any object, picture, or photograph, and having both lantern slide and microscopic slide attachments, this instrument is proving of great value to the members.



THE OPOSSUM MOUSE.  
*Dromicia nana*.

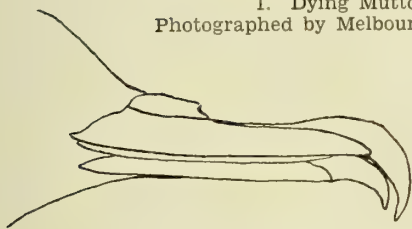
Photographs by Norman Chaffer.  
Design by Neville W. Cayley.



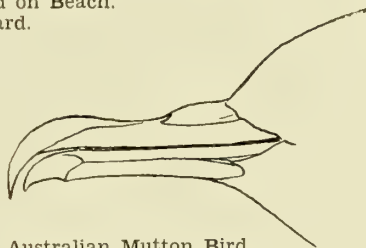




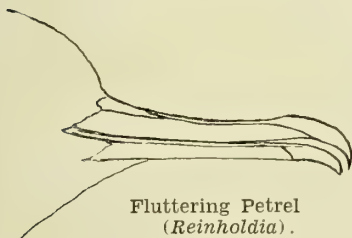
1. Dying Mutton Bird on Beach.  
Photographed by Melbourne Ward.



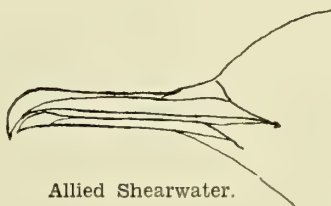
New Zealand Mutton Bird.



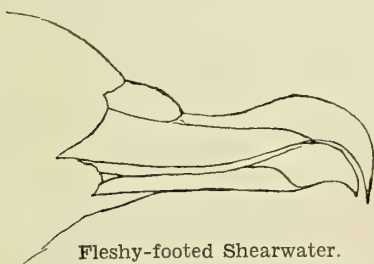
Australian Mutton Bird.



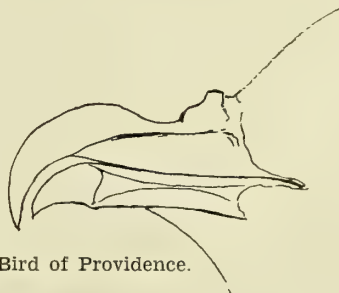
Fluttering Petrel  
(*Reinholdia*).



Allied Shearwater.



Fleshy-footed Shearwater.



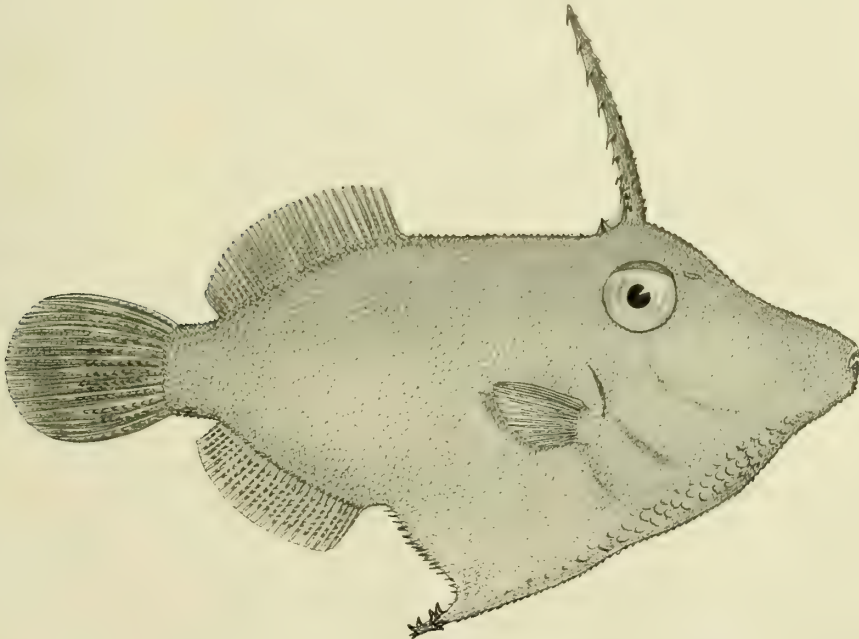
Bird of Providence.

Bills of Petrels and Shearwaters.





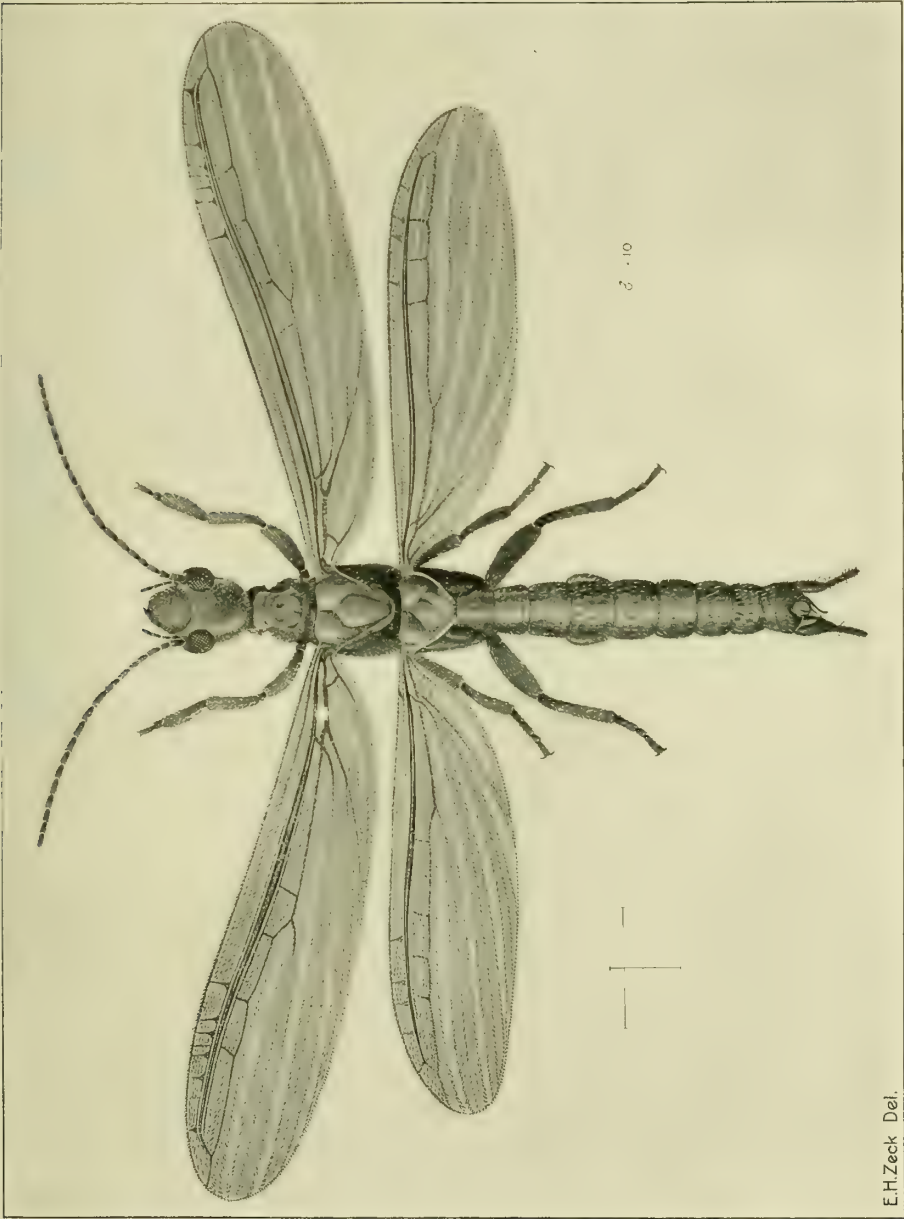
1. *Epinephelus ergastularius* Whitley, nov.  
Joyce K. Allan, del.



2. *Stephanolepis (Pervagor) alternans* (Ogilby).  
F. A. McNeill and G. P. Whitley, del.





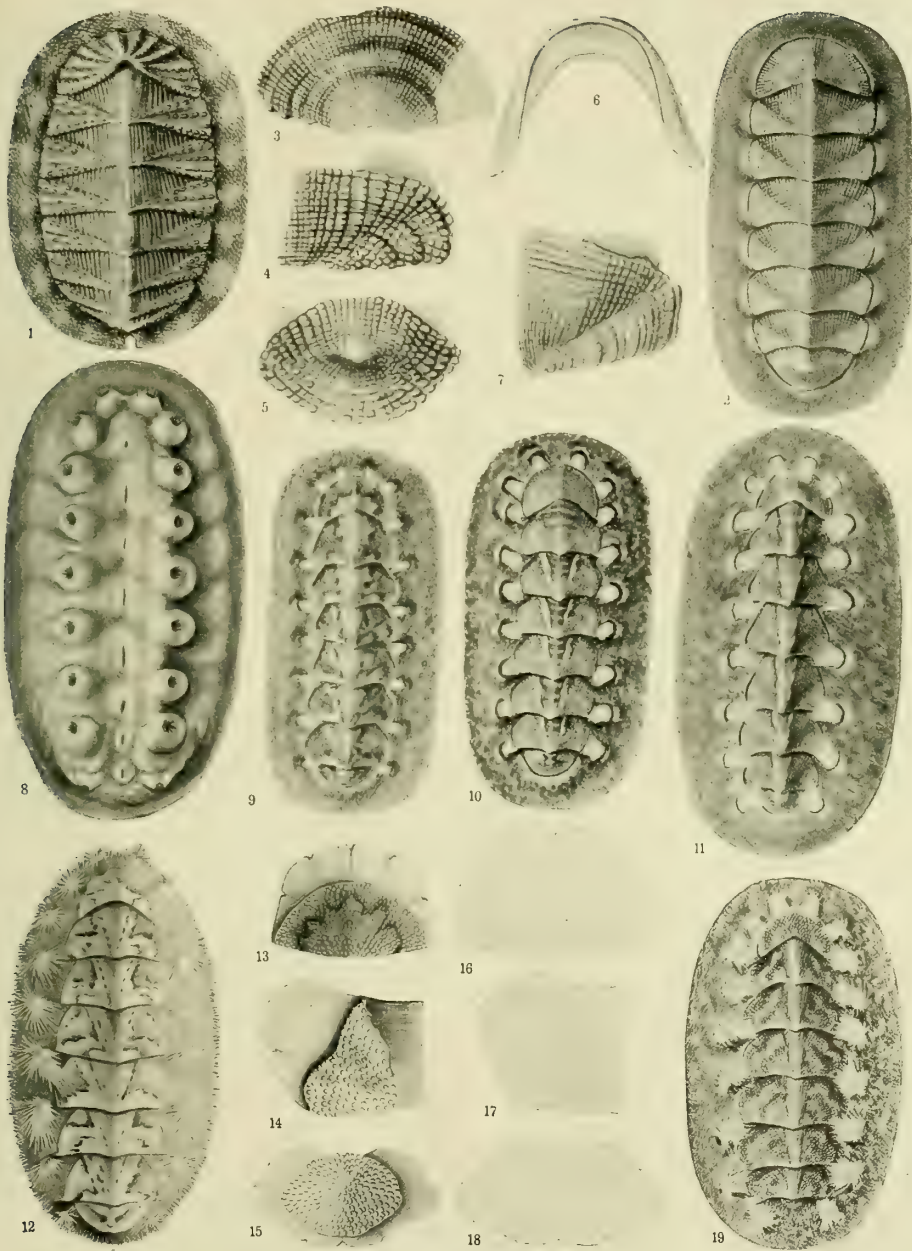


E.H. Zeck Del.

*Oligotoma gurneyi* Froggatt.

E. H. Zeck, del.



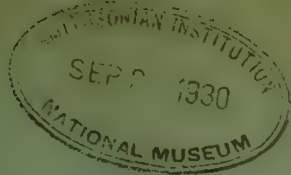


NEOZELANIC LORICATES.

Joyce K. Allan and Phyllis Clarke, del.







# THE AUSTRALIAN ZOOLOGIST

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Issued by the  
Royal Zoological Society of New South Wales

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Edited by  
A. F. BASSET HULL, C.F.A.O.U.

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# Royal Zoological Society of New South Wales.

Established 1879.

REGISTERED UNDER THE COMPANIES ACT, 1899 (1917).

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COUNCIL, 1930-1931.

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## *President:*

Professor W. J. Dakin.

## *Vice-Presidents:*

Neville W. Cayley, J. R. Kinghorn, C.M.Z.S., Anthony Musgrave, F.E.S.,  
and G. A. Waterhouse, D.Sc., B.E., F.E.S.

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A. H. Chisholm.	T. C. Roughley.
E. A. D'Ombraïn, M.B., B.S.	David G. Stead.
W. W. Froggatt, F.L.S.	Ellis Le G. Troughton.
Aubrey Halloran, B.A., LL.B.	

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*Hon. Treasurer:* Phillip Shipway.

*Hon. Librarian:* A. S. Le Souef, C.M.Z.S.

*Hon. Auditor:* R. J. Stiffe, A.C.A. (Aust.)

## OFFICERS OF SECTIONS:

### *Avicultural Section.*

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Hon. Secretary: T. Butler.  
Committee: Clifford Coles, C.M.Z.S., H.  
E. Peir and W. Turner.

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F.E.S.  
Vice-Chairman: H. J. Carter, B.A., F.E.S.  
Hon. Secretary: Keith C. McKeown.

### *Marine Zoological Section.*

Chairman: Tom Iredale.  
Vice-Chairman: G. P. Whitley.  
Hon. Secretary: W. Boardman.

### *Ornithological Section.*

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Vice-Chairman: J. K. Hindwood.  
Hon. Secretary: Neville W. Cayley.  
Committee: A. H. Chisholm, Clifford  
Coles, C.M.Z.S., P. A. Gilbert, J. R.  
Kinghorn, C.M.Z.S., and Keith C.  
McKeown.  
Hon. Secretary Field Club: J. K. Hind-  
wood.

# Royal Zoological Society of New South Wales.

## THE ANNUAL MEETING.

The fifty-first annual meeting of the Royal Zoological Society of New South Wales was held at Macleay House (The Linnean Society of New South Wales) on Wednesday, 23rd July, 1930, at 8 p.m., thirty members being present. The honorary secretary read the

## FIFTY-FIRST ANNUAL REPORT.

### *Members.*

On 30th June, 1930, there were 522 members on the register, divided into the various categories, as follows: Associate benefactors 4, life members 27, ordinary members 281, honorary members 6, honorary associate members 4, life associate members 21, associate members 179. Twelve members died during the year and fifteen resigned. As compared with the previous year there was a net increase of 69 members.

### *Deaths.*

Of the members lost to us by death during the year, Messrs. Gustavus John Waterhouse, Frederic Owen Bennett, Joseph Burdekin Holdsworth and Albert Edward Phillips were life members. Mr. Waterhouse was for many years a keen supporter of the Society and its activities, and members of Council frequently met him in his office, the lease of which was subsequently transferred to the Society.

### *The Council.*

Dr. A. J. Nicholson resigned during the year in consequence of his appointment to the Commonwealth Division of Economic Entomology, and his transfer to the Capital. Mr. A. S. Le Souef, C.M.Z.S., formerly honorary librarian and during a period in 1916-17 honorary secretary of the Society, was elected to fill the vacancy.

Ten meetings of the Council were held during the year, at which the attendances were very satisfactory. Messrs. Coles and Pollock, who were on leave of absence during part of the year, visited England, and represented the Society at several functions in London, and exhibited lantern slides of many of our most interesting birds and animals, their illustrated talks being very much appreciated by zoologists on the other side. Mr. Coles has since been elected corresponding member of the Zoological Society of London. Mr. E. J. Bryce was granted leave of absence for the latter part of the year, and he is visiting India, Persia and the Continent of Europe.

### *Sections.*

The Biological Survey Section has been disbanded, and a Committee appointed to deal with the biology of National Park in its place. A new section—the Avicultural—has been established, and the membership already exceeds fifty. This section will deal more particularly with the keeping and breeding of the rarer species of Australian birds in captivity.

The several sections, Entomological, Marine Zoological and Ornithological are maintaining their activities, the seating accommodation at many of the meetings being taxed to the utmost.

*The Australian Zoologist.*

Parts 1 and 2 of Volume 6 were issued during the year. It is interesting to note the increasing number of applications from British and foreign scientific Societies to be placed on our exchange list.

*Finances.*

A glance at the balance sheet will show that the Society has never been in a better position, this satisfactory result having been largely contributed to by the efforts of the Women's Auxiliary. Further contributions to this fund not previously acknowledged include £20 from the Walter and Eliza Hall Trust, £5 from Countess Freehill and several small amounts.

*Associate Benefactors.*

For his valuable services to the Society, Dr. Gustavus Athol Waterhouse has been elected an associate benefactor. We have now four associate benefactors on our roll.

*Taronga Park Trust.*

The relations between the Society and the Trust have been of an increasingly cordial nature during the past year. The Trustees have on numerous occasions availed themselves of the expert advice of members of the Society. The number of members granted privileges of admission to Taronga Park has been increased to 350.

*Handbook Publication Fund.*

Although this fund has nearly reached £800, it is still far short of the amount required to enable the Society to produce handbooks as originally designed. However, it is proposed to make a commencement by publishing small handbooks, defraying the cost partly from the income of the fund and partly from general account, with the view of refunding the latter advance from sales of the handbooks.

*Balance Sheet.*

The honorary treasurer, Mr. Phillip Shipway, then presented the balance sheet for the year ending 30th June, 1930, and referred to the increased assets as shown therein, attributing this largely to the splendid efforts of the Women's Auxiliary, in organising a ball, which resulted in one hundred guineas being added to the handbook publication fund. He moved the adoption of the report and balance sheet, which was seconded by Dr. Charles Anderson and supported by Mr. Aubrey Halloran.

*Election of Councillors.*

The six retiring members of Council under Article 23, namely, Messrs. A. H. Chisholm, W. W. Froggatt, A. S. Le Souef, A. Musgrave, E. F. Pollock and Dr. E. A. D'Ombraïn were re-elected members of Council for the year 1930-31.

*Amendment of Articles of Association.*

On the motion of the honorary secretary, seconded by Mr. Pollock, it was resolved to amend the Articles of Association, as follows:—

"That Article 5 be amended by the insertion of the words 'and fifty' after 'three hundred' in such Article."

On the motion of the honorary secretary, seconded by Mr. Chisholm, and supported by Mr. Halloran, it was resolved:—

"That Article 17a be amended by the insertion of the following paragraph at the end of such Article:—

"(b) Upon any member or associate member who has rendered valuable service to Australian Zoology, the title 'Fellow.'"



*Other Business.*

The President then presented the Diploma of Associate Benefactor to Dr. G. A. Waterhouse.

Mr. A. H. Chisholm tabled a copy of the first number of "The Ostrich," the organ of the South African Ornithological Society, and suggested that the felicitations of our Society be conveyed to our South African confrères, with congratulations on the excellent appearance of their Journal.

It was resolved to convey the Society's regrets to Mrs. Norman Lowe, President of the Women's Auxiliary, on her serious illness, with the hope that she would soon be restored to health. The Society's congratulations were conveyed to Mr. Aubrey Halloran on his election as Grand Master of the United Grand Lodge of Freemasons of New South Wales, and to Dr. G. A. Waterhouse upon his election as President of the Trustees of the Australian Museum.

On the motion of Mr. Pollock, seconded by Mr. Cayley, it was resolved that the President place on record a minute testifying to the excellent work performed by the honorary secretary.

The President then delivered his address (vide p. 189).

*Special General Meeting.*

A special general meeting was held at the Society's office on 6th August, 1930, at which the Resolutions as to Amendment of Articles of Association 5 and 17a were confirmed.

*Officers for 1930-31.*

The following officers were elected:—

President.—Professor W. J. Dakin, D.Sc.

Vice-Presidents.—Neville W. Cayley, J. R. Kinghorn, C.M.Z.S., Anthony Musgrave, F.E.S., and G. A. Waterhouse, D.Sc., B.E.

Honorary Secretary and Editor.—A. F. Basset Hull, C.F.A.O.U.

Assistant Honorary Secretary.—Clifford Coles, C.M.Z.S.

Honorary Treasurer.—Phillip Shipway.

Honorary Librarian.—A. S. Le Souef, C.M.Z.S.

*New Members.*

The following new members have been elected since the publication of the last list (January 14, 1930):—

Ordinary Members.—A. B. Ashton-Hansen, W. G. F. Brain, Mrs. E. Brian, R. Buggy, Miss E. F. Carter, F. Cummins, Miss P. M. Crossley, L. Clemens, N. Caldwell, J. R. Davidson, G. Fitzpatrick, Dr. L. G. H. Huxley, E. Henderson, Miss E. Husband, N. King, A. King, N. G. Lawrence, D. Lammers, D. Milsop, Mrs. N. Markham, H. G. Paul (previously associate), S. Rohu, W. J. Rogers, M. Rae, W. Tibbits, J. H. Tomalin, C. W. Taylor, F. H. Taylor, A. C. Wilcox.

Associate Members.—Miss G. Aguilar, Dr. R. Brown, T. Butler, A. J. Carruthers (previously ordinary), Miss M. Crawford, A. E. Clarke, G. Clappitt, C. Camp, R. W. Clarke, J. Creevey, Mrs. Vane Daniel, Miss C. Dunphy, F. Ellis, D. Edwards, J. Fleming, W. Fraser, Dr. Goodwin, Mrs. E. M. Huxley, E. Hargreaves, J. Hargreaves, W. S. Hollingsworth, A. G. Hamilton (formerly ordinary), J. K. S. Houson, L. James, E. W. Jones, J. T. Jones, Mrs. J. R. Kinghorn, H. Lyons, H. D. Lanecky, J. S. Mackie, B. W. May, A. Manners, R. Manners, B. Moody, F. Mutton, V. Martin, H. E. Peir, G. F. Packer, G. A. Parsons, C. S. Ross, C. E. Steeles, C. B. Scott, C. W. Springall, W. H. Turner, P. H. Tancred, Dr. Thompson, A. Whiteley, J. E. Ward, J. White, R. White, A. J. Wilkes.

# ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES.

BALANCE SHEET AS AT 30th JUNE, 1930.

LIABILITIES.			ASSETS.		
	£	s. d.		£	s. d.
General Capital Account .. .	791	5 0	General Capital Account—		
General Income Account .. .	59	6 10	Commonwealth In-		
Hand Book Fund Capital Ac-			scribed Stock		
count .. . . . .	703	2 6	(f.v. £650) .. .	641	5 0
Hand Book Fund Income Ac-			N.S.W. Govern-		
count .. . . . .	79	8 1	ment Debenture	100	0 0
			N.S.W. Govern-		
			ment Funded		
			Stock .. . . .	50	0 0
					791 5 0
			General Income Account—		
			Commercial Bank-		
			ing Company of		
			Sydney, Ltd. ..	6	2 3
			Less Outstanding		
			Cheques .. . . .	8	8 8
			Overdraft .. . . .	2	6 5
			Government Sav-		
			ings Bank of		
			N.S.W. .. . . .	61	13 3
					59 6 10
			Hand Book Fund Capital Account—		
			Commonwealth		
			Treasury Bonds		
			(f.v. £700) .. .		703 2 6
			Including—		
			Albert Littlejohn		
			Endowment ..	100	0 0
			Hume-Barbour		
			Endowment ..	106	0 0
			Walter & Eliza Hall		
			Trust Endowment	160	0 0
			Hand Book Fund Income Account—		
			Government Sav-		
			ings Bank of		
			N.S.W. .. . . .	70	4 2
			Cash on Hand ..	9	3 11
					79 8 1
					£1,633 2 5

## HAND BOOK FUND INCOME ACCOUNT.

RECEIPTS.			DISBURSEMENTS.		
	£	s. d.		£	s. d.
To Balance 30th			By Investments ..		197 15 0
June, 1929 .. .		34 9 4	„ Balance 30th June, 1930—		
„ Donations—			Government		
R. C. Dixon, Esq. 25 0 0			Savings Bank		
A. A. Lawson, Esq. 50 0 0			of N.S.W. .. .	70	4 2
W o m e n ' s			Cash on Hand ..	9	3 11
Auxiliary .. .	105	0 0			79 8 1
Countess Freehill	5	0 0			
Walter and Eliza					
Hall Trust ..	20	0 0			
Amounts under					
Five Pounds ..	3	12 6			
		208 12 6			
„ Hand Book Sales—					
„ “Loricates” .. .	1	6 0			
„ “Fishes” of					
N.S.W.” .. .	3	2 4			
		4 8 4			
„ Interest on In-					
vestment .. .		29 12 11			
		£277 3 1			£277 3 1

### GENERAL INCOME ACCOUNT.

RECEIPTS.				DISBURSEMENTS.			
		£	s. d.	£	s. d.	£	s. d.
To Balance	30th						
June, 1929 . . . .				98	3 3		
„ Subscriptions—							
Annual . . . . .	333	15	9				
Life . . . . .	21	0	0				
				354	15 9		
„ Donations . . . . .				1	1 0		
„ Sales "Australian Zoologist"							
and Reprints . . . . .				11	0 9		
„ Rent of Office . . . . .				52	12 11		
„ Annual Dinner . . . . .				11	5 0		
„ Interest on Investments . .				43	15 10		
„ Bank Exchange . . . . .				0	9 0		
„ Refund of Duty on Epi-							
diascope . . . . .				4	13 9		
„ Payment from C.S. and I.R.							
towards 'Phone Account . .				1	16 1		
							</

Audited and found correct.  
(Sgd.) ROBT. J. STIFFE, A.C.A. (Aust.),  
Hon. Auditor.  
Sydney, 18th July, 1930.

(Sgd.) PHILLIP SHIPWAY,  
Hon. Treasurer.

## REPORTS OF SECTIONS.

## ENTOMOLOGICAL SECTION.

Ten ordinary meetings of the section were held at the Society's room, Bull's Chambers, during the past twelve months, with an average attendance of nine.

At one period the attendance at meetings declined to such an extent that it was feared that a reduction in the number of meetings of the section would be necessary, but it is pleasing to report that attendances have since greatly improved, and the average at the last three meetings has been fourteen.

Following on the departure of Dr. Nicholson to Canberra, F.C.T., on his appointment to the Federal Division of Economic Entomology, Dr. G. A. Waterhouse was elected to the chair at the March meeting.

The following lectures were delivered before the section:—

Mr. A. Musgrave: Early French Explorers and their work in relation to Australian Entomology.

Mr. A. R. Woodhill: The Apple and Citrus Root Weevil (*Leptops squavidus*); its Binomics and Control.

Mr. W. W. Froggatt: Insect Galls.

KEITH McKEOWN, Hon. Secretary.

## NATIONAL PARK RESEARCH COMMITTEE.

The Biological Survey Section of the Royal Zoological Society of New South Wales was disbanded after its annual general meeting on August 21, 1929, as it was considered that the proposed biological survey was impracticable. At the same time, the National Park Research Committee was formed to co-ordinate biological work in National Park. This committee consists of two members of each section of the Society, and two members of the National Park Trust, with power to co-opt other scientific workers. The following gentlemen were elected at the inaugural meeting of the committee on September 27, 1929: Mr. A. Musgrave (chairman), Dr. G. A. Waterhouse, Messrs. W. F. Leighton Bailey, A. H. Chisholm, T. Iredale, K. Hindwood, N. Cayley, F. A. McNeill and G. P. Whitley (hon. secretary).

The main business before the committee is the preparation of a popular "Handbook to National Park," with special reference to its natural features, fauna and flora. Mr. T. Iredale has been appointed editor and Mr. N. Cayley business manager. The manuscript of several chapters has been completed, but a few more contributions are outstanding. Owing to generally unsettled financial conditions, the production of the handbook has been temporarily deferred, and no meetings of the committee have been held since last January.

Various members of the Society visited the cottage at Gundamalan during the year to study the fauna of the Park.

GILBERT P. WHITLEY, Hon. Secretary.

## MARINE ZOOLOGICAL SECTION.

The year 1929-30, under the chairmanship of Mr. Tom Iredale, completes the fourth, and a most successful year of the section. During the period members individually and the section as a body, have helped considerably to advance various branches of Australian marine zoology.

Messrs. Iredale, McNeill and Johnson have worked consistently and systematically towards a solution of some of the problems presented by the marine wood-boring pests in Port Jackson, and they hope to publish the results of their research shortly.



Two committees, viz., that dealing with the harbour pollution question and that engaged on the publication of the new National Park Handbook requested the support of the section, and to each of them representatives were elected.

For a long time the section has been alive to the need of an ecological survey of a defined locality on the New South Wales coast, and it was decided to carry out this work at the Bottle and Glass Rocks, Port Jackson, under the leadership of the chairman. Preliminary zoning and observation have already been done. This work, however, though interesting alike to scientist and layman, would by reason of its nature be essentially technical. To cater for the more popular need a committee was appointed to go into the question of producing a popular handbook of the New South Wales marine fauna, and in this task also a definite start has been made.

In accord with the policy of the section, lantern lectures have been a feature at most of the meetings. The year's list is as follows:—

August 12.—“The Recent Sydney Meeting of the Commonwealth Fisheries Committee.” By T. C. Roughley.

September 2.—“Some Plant-like Animals.” By W. Boardman.

October 14.—“Dredging in Port Jackson.” By Tom Iredale.

November 4.—“Life in a Mangrove Swamp.” By A. Musgrave.

December 9.—“Barnacles.” By M. Ward.

January 13.—“A Naturalist in North and North-west Australia.” By A. A. Livingstone.

February 3.—“The Capricorn Group and the nearby Mainland.” By M. Ward and W. Boardman.

March 3.—“Coral Reef Fishes.” By G. P. Whitley.

April 7.—“Marine Reptiles.” By J. R. Kinghorn.

May 5.—“Recent Investigations on Wharf Pile Pests.” By Messrs. Iredale, McNeill and Johnson.

June 2.—Discussion on Economic Zoology. By Messrs. Whitley, Roughley and McNeill.

TOM IREDALE, Chairman.

W. BOARDMAN, Hon. Secretary.

#### ORNITHOLOGICAL SECTION.

During the past year eleven meetings were held, the attendances on each occasion taxing the present seating accommodation to its utmost, a sure sign of the popularity of sectional meetings.

All lecturettes proved most instructive, and all were beautifully illustrated by photographs, the work of our members. The photographic records and carefully kept field observations have added considerably to our knowledge of many species. In this connection, the results obtained during the past season by Mr. K. A. Hindwood and Mr. Norman Chaffer deserve special mention. Other members who have done excellent work in the field are: Messrs. H. H. Innes, G. R. Gannon, J. Marshall and A. J. Gwynne.

To Mr. A. H. Chisholm we offer our thanks and congratulations on his excellent work, “Birds and Green Places.” This book has set a standard of literary, scientific and popular excellence, and has been acclaimed abroad and in America, as well as here in Australia, as the outstanding work on Australian birds so far produced by an Australian.

The visit to Bullahdelah, North Coast, during October by a party, under the leadership of Mrs. C. A. Messmer, proved most disappointing. It rained during the whole period and little field work was possible.

A summary of the lecturettes delivered during the year is as follows:—

## 1929—

July 19th.—Mr. T. Iredale. "Birds of the Antarctic."

August 16th.—Mr. G. P. Whitley. Lecturette on "Flight."

September 20th.—Mr. Norman Chaffer. Exhibition of Photographs.

October 18th.—Mr. T. Iredale. "New Zealand Birds."

November 15th.—Discussion on "Birds of Paradise." By Messrs. Iredale, Cayley, Hull and Le Souef.

## 1930—

January 17th.—Mr. A. S. Le Souef. "The Psychology of Bird Action."

February 21st.—Mr. K. A. Hindwood. Exhibition of Photographs.

March 21st.—Mr. Clifford Coles. "Travel Talk."

April 24th.—Mr. K. A. Hindwood. "Bush Rambles."

May 16th.—Mr. T. Iredale. "Genus Podargus."

June 20th.—Mr. H. Fletcher. "Antarctic Birds."

NEVILLE CAYLEY, Hon. Secretary.

## SECTIONAL MEETINGS.

*Syllabus for the year 1930-1931.**Avicultural Section:*

(Second Monday in the month.)

11 August . . . . .	1930.
8 September . . . . .	"
13 October . . . . .	"
10 November . . . . .	"
8 December . . . . .	"
12 January . . . . .	1931.
9 February . . . . .	"
9 March . . . . .	"
13 April . . . . .	"
11 May . . . . .	"
11 June (Thursday) . . . . .	"

*Marine Zoological Section:*

(First Monday in the month, except when a Public Holiday, then on the following Tuesday.)

5 August (Tuesday) . . . . .	1930.
1 September . . . . .	"
7 October (Tuesday) . . . . .	"
3 November . . . . .	"
1 December . . . . .	"
5 January . . . . .	1931.
2 February . . . . .	"
2 March . . . . .	"
7 April (Tuesday) . . . . .	"
4 May . . . . .	"
1 June . . . . .	"

*Entomological Section:*

(Second Wednesday in the month.)

13 August . . . . .	1930.
10 September . . . . .	"
8 October . . . . .	"
12 November . . . . .	"
11 February . . . . .	1931.
11 March . . . . .	"
8 April . . . . .	"
13 May . . . . .	"
10 June . . . . .	"

*Ornithological Section:*

(Third Friday in the month.)

15 August . . . . .	1930.
19 September . . . . .	"
15 October . . . . .	"
21 November . . . . .	"
19 December . . . . .	"
16 January . . . . .	1931.
20 February . . . . .	"
20 March . . . . .	"
17 April . . . . .	"
15 May . . . . .	"
19 June . . . . .	"

Meetings of the Sections are held at the Society's office, Bull's Chambers, 28 Martin Place, Sydney, at 7.30 p.m., and are open to all members, associates and their friends.

Notices will be sent to members when a change is made in the date of a meeting.

## PRESIDENTIAL ADDRESS.

## THE HISTORY OF AUSTRALIAN ENTOMOLOGICAL RESEARCH.

By ANTHONY MUSGRAVE.

The History of Research in Australian Entomology is so interwoven with the country's political history that a study of the science is scarcely possible without due regard being paid to those factors which have led to the foundation of our Commonwealth.

In 1841 there appeared an excellent account by Adam White, of the British Museum, on Entomological Research on Australian Insects (1), and in which he stated: "It would take up too much time to give a tithe of the names of the entomologists who have described New Holland insects, as nearly every working student of insects abroad and at home has added to the list." In a footnote he adds: "The entomologist who would attempt to do this must give a Universal Entomological Bibliography, as scarcely a Journal or volume of Transactions of any Scientific Society appears without containing fewer or more species from the great Australasian Continent and its islands."

Having spent over twenty years in the study of Australian Entomological Literature, I fully endorse all that Adam White wrote on this subject 90 years ago.

Three periods may be distinguished in our Entomological History. The first, the Fabrician Period, from 1770 to 1830, when French and British Expeditions charting our shores collected and took back to Europe the curiosities of the Antipodes; the second, the Westwoodian Period, between 1831 and 1862, when the continent was becoming gradually peopled and many specimens were sent to England by settlers; the third, the Macleayan Period, dating from 1862 to the present day. In 1862 the Entomological Society of New South Wales was founded, and henceforth students of Entomology in Australia were able to carry out much of the work which hitherto had been the prerogative of their European confreres.

The late J. J. Fletcher has given a most comprehensive account of the Macleays in his Presidential Address to the Linnean Society of New South Wales (2), in which he deals not only with that distinguished family, but with their contemporaries, so that we gain an insight into Australian Zoological Research from 1825 (the year Alexander Macleay arrived in Australia) to 1891 (the date of Sir William Macleay's death). It will be seen that the Macleays played a very active part in all three periods of our past history.

These three periods I will now consider in detail.

## THE FABRICIAN PERIOD: 1770-1830.

As no insects beyond flies, and ants' (termites') nests, appear to have been mentioned by the early Dutch navigators who landed on the west coast of New Holland, Australian Entomological Research may be said to date from 29th April, 1770, when Banks and Solander, the naturalists on Captain

(1). Adam White, in George Grey, *Journals of two Expeditions of Discovery in North-west and Western Australia, during the years 1837-38 and 1839, under the Authority of Her Majesty's Government, etc.*, vol. ii., 1841. Appendix F., pp. 450-482. Notes on some Insects from King George's Sound, collected and presented to the British Museum by Captain George Grey.

(2). J. J. Fletcher, "The Society's Heritage from the Macleays." *Proc. Linn. Soc. N.S. Wales*, xlv., 4, 1920 (1921), pp. 567-635. "The Society's Heritage from the Macleays," Part ii., *ibid.*, liv., 3, 1929, pp. 184-272. (The second part issued posthumously and edited by Dr. A. B. Walkom).

James Cook's vessel, the *Endeavour*, made their first collections of insects at Botany Bay.

Here a week was spent botanizing and exploring, and probably but few insects were collected owing to the lateness of the season. No mention is made of any insects secured at Botany Bay in any of the published journals, but it was probably here that they met with the beautiful Curculionid, *Chrysolophus spectabilis* (Fabricius, 1775, *Curculio*), a species popularly known as the Botany Bay Diamond Beetle, which occurs on Acacias commonly about Sydney and Botany Bay and which was collected during the visit of the Expedition to East Australia. Another insect secured by the Expedition, and which almost certainly was taken at Botany Bay, was the female of the "Common Brown," *Heteronympha merope* (Fabricius, 1775, *Papilio*).

The next spot at which Cook and his party landed was Bustard Bay, on Wednesday, 23rd May, and here they met with the nests of the Green Tree Ants, *Oecophylla virescens* (Fabricius, 1775, *Formica*), in the branches of the Mangroves. This was the first record of this interesting ant. They also encountered caterpillars, probably those of a Limacodid moth.

At Thirsty Sound, parties landed on Tuesday and Wednesday, 29th and 30th May, and here both Banks and Sydney Parkinson (an artist) record meeting with "ants nests, made of clay as big as a bushell," on the branches of the gum trees, and Parkinson mentions the Green Tree Ant again. Banks notes, too, the presence of a small black ant which lived in the branches of a tree, *Xanthoxyloides mite*, "living in quantities in the hollow part where the pith should be." Here the butterflies also attracted the attention of Banks, one species occurring in millions. He also found "a pupa or chrysalis which shone as brightly as if it had been silvered over with the most burnished silver, which it perfectly resembled." It emerged next day, and from the brief description he gives we conclude that he had secured a specimen of *Euploea corinna* Macleay, 1826, a species stated to be among the Banksian insect types, but not described from that collection.

Palm Island and Cape Grafton were next visited, but nothing is told us of their insect fauna. Then occurred the mishap which threatened the lives of all on board the vessel. The *Endeavour* grounded on a reef, but was floated off next day, and was warped into the Endeavour River on Monday, 18th June, where she remained until 4th August.

It is more than probable that most of the insects collected by Banks and Solander were captured at the Endeavour River. This holds good, particularly for the butterflies, as Mr. T. G. Watkins has pointed out in a paper, entitled *Notes on the Butterflies of the Banks Collection* (3), that, "as there had been no previous scientific voyage to New Holland and there was no subsequent return from one prior to the publication of the *Systema*, in 1775, it may be assumed that all these types were obtained during the enforced sojourn at the future Cooktown in North Queensland in June to August, 1770."

Such butterflies as *Danaida affinis*, *Cupha prosope* and *Hypolimnys bolina nerina* are species commonly met with in North Queensland, and it is only reasonable to believe that these forms, later described by Fabricius, were secured at the Endeavour River.

Hawkesworth, in his account of *Captain Cook's First Voyage* (4), gives

(3). T. G. Watkins. *The Entomologist*, lvi., September, 1923, pp. 204-209.

(4). In Vol. iii., Chapter viii., *Departure from New South Wales; a particular Description of the Country, its Products, and People, etc.*, 1773, pp. 627-630.



notes on the entomological novelties met with. Here for the first time we read of the Green Tree Ant, and an interesting account is given of the ants which frequent the natural cavities of the epiphytic plants, popularly known as "ant plants."

These parasites occur on the branches of trees, and I have seen photographs of them taken at Cooktown, so that the plant and its inhabitants almost certainly were seen at the Endeavour River by the members of Captain Cook's party.

The descriptions of the insects in Hawkesworth's account are without doubt taken from the Journal of Banks, for if a comparison be made it will be seen that they are practically identical.

Cook's first voyage, so far as Australia is concerned, terminated at Possession Island, where he took possession of the whole of the east coast of New Holland for Great Britain, calling it New South Wales.

On the return of the Expedition to England, the Journal of Sydney Parkinson, the artist on the *Endeavour*, who had died after leaving Batavia on 26th January, 1771, was edited by his brother, Stanfield Parkinson, and published in 1773. It contains the first published reference to Australian "sand-flies" (*Ceratopogon* ?), which he met with at the Endeavour River, and he has also something to say about ants.

Earlier in the same year Hawkesworth had edited and published Captain Cook's Journals, together with extracts from the Journal of Sir Joseph Banks, and in the third volume of Cook's Voyages, which treats with the exploration of the east coast of Australia, appear references to some of the insects encountered.

It was not until 1896 that the Journal of Banks was published, being edited by Sir Joseph D. Hooker. In treating with Sir Joseph Banks I should like to draw attention to Maiden's valuable work, *Sir Joseph Banks: "The Father of Australia,"* 1909, in which is given a wealth of information concerning Banks and his contemporaries.

It was not, however, until 1775 that the first scientific descriptions of the insects collected by Banks and Solander, in New South Wales, appeared from the pen of Fabricius, a pupil of the great Swedish naturalist, Linné. In his *Systema Entomologiae* he records 212 species of insects from Australia.

In his third and last voyage Cook, in the *Resolution*, put in at Adventure Bay, Tasmania, for five days from 26th to 30th January, 1777. In his Journal (5) he gives a note on the insects met with. On 14th February, 1779, Cook met his death at the hands of the natives of Hawaii.

On 20th January, 1788, the First Fleet under Governor Phillip arrived at Botany Bay. Six days later the ships of La Perouse's Expedition, *La Boussole* and *L'Espérance*, put into Botany Bay to refit after coming from Samoa. Here Father Receveur, the naturalist, who had been wounded at Tutuila, died, and was buried, a simple monument now marking his grave. After refitting, La Perouse set sail on 10th March, and all trace of him was lost to the civilized world for 38 years, until remains of the Expedition were found at Vanikoro. Expeditions sent in search of him failed to glean any knowledge of his vessels' whereabouts, but by the indefatigable efforts of the naturalists accompanying these search vessels much valuable material was collected which added materially to the knowledge of Australian Entomology.

The first of these Expeditions took place during the years 1791-1794 and was under the command of General Bruni D'Entrecasteaux, and La Billardiére and Riche were the naturalists of the Expedition.

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(5). Published in *A Voyage to the Pacific Ocean*, Vol. i., 1784, p. 111.

In the *Recherche* and *Espérance* they visited Tasmania, sailing thence to the Solomon Islands and the Malay Archipelago, and then south again to South-west Australia and Southern Tasmania. Sailing north they put in at New Caledonia, where Huon Kermadec, the second in command, died, and when in the vicinity of New Britain, D'Entrecasteaux also succumbed.

The insects collected by La Billardiére and Riche were described by Fabricius in his *Systema Eleutheratorum* (1801), *Systema Rhyngotorum* (1803), and *Systema Piezatorum* (1804), while Latreille (1802), re-described and figured two species of "Bull Dog" ants and other Australian species, and Lamarck (1804) described and figured two new genera and species of Australian insects.

Then in 1800-1803 came the historic Expedition of Nicholas Baudin, which has been described in all its particulars by Professor E. Scott in his *Terre Napoléon*. Baudin was in command of two vessels, the *Géographe* and the *Naturaliste*, and a small vessel, the *Casuarina*, was acquired at Port Jackson for survey work.

Péron was the naturalist and Le Sueur the artist. Mauge, another naturalist, died in Tasmania. Mr. Tom Iredale has pointed out, in an article in the *Australian Museum Magazine*, in which he deals with the French naturalists, that their names run in pairs. Thus we had La Billardiére and Riche, in 1791-1794, and now we have Péron and Le Sueur.

Much valuable work in charting the coasts of Tasmania and Australia was performed and collections of insects were made at Adventure Bay, Tasmania, Sydney, King Island and Kangaroo Island.

No detailed scientific results of the entomological work carried out appeared with the narrative of the Expedition, but in Vol. ii. of the *Voyage de Découvertes*, etc., supervised by Péron, appears a description of a new species of earwig from Bruny Island, Tasmania, called *Forficula Antarctica*, and a description of the Fiddler Beetle, from near Parramatta, which he calls *Cetonia Orpheus*. In Vol. iii. of the same work appears an interesting account of the insects found on Kangaroo Island, and a comparison with those found on King Island in Bass Strait. Species collected by Baudin (?), and Péron and Le Sueur, were described by Lamarck (1804); Latreille (1809, 1811, 1818, 1824); Bonelli (1813), and Godart (1819, 1824).

Contemporaneously with Baudin's Expedition was that of Matthew Flinders, in the *Investigator*, who did detailed survey work of the Australian coast. In a footnote to his book, *A Voyage to Terra Australis*, he proposed the name "Australia" for this continent. With Flinders was Robert Brown, the botanist, who collected insects in Australia between 1801-1805, species being described by Kirby (1818), Leach (1819), Macleay (1819). Four Australian insects collected by him carry the specific name *brownii*.

In the year 1805 appeared the beautiful work, "*An Epitome of the Natural History of the Insects of New Holland*, etc.," by Edward Donovan, with 41 coloured plates and with descriptions of many new species. Many of the insects described by Fabricius were here figured for the first time. It was a notable contribution to Entomology.

During the same year John William Lewin published his *Prodromus Entomology—Natural History of Lepidopterous Insects of New South Wales*, with 18 plates, coloured by hand. Though the work was published in London, the plates were drawn and engraved in Sydney by him. He was one of the first artist-naturalists in Australia, as he arrived here in 1800. The late J. J. Fletcher (6), published a letter dated 20th February, 1805, from Alexander Macleay to Kirby, in which the former states: "I have been

(6). J. J. Fletcher, Presidential Address, *Proc. Linn. Soc. N.S. Wales*, xlv., 4, 1920 (1921), p. 572.

describing eighteen Botany Bay Lepidopterous Insects which are about to be published by Lewin, with all their changes and natural history." As some doubt has been expressed as to the truth of the contention that Alexander Macleay wrote the descriptions of the species for Lewin, this letter should silence the doubters for ever.

Fletcher gave a great amount of information about Lewin in his address, and W. W. Froggatt has published recently, in the *Australian Naturalist* for January, 1930, an account of Lewin, "The First Field Naturalist in Australia."

About this time there lived at Chelsea, in London, an artist, William Jones, who made paintings of butterflies from specimens in his own cabinets, and from those in other collections, which constitute his *Icones*, a manuscript work of six volumes, now in the Hope Department of the Oxford University Museum. Fabricius, in his work, *Entomologia Systematica*, Vol. iii., published descriptions of five new species of butterflies known to occur in Australia, and cited some of these figures with his descriptions. Donovan also referred to these *Icones*.

From 1817-1820, Louis de Freycinet, who had been a lieutenant during Baudin's Expedition, commanded an expedition, consisting of two vessels, the *Uranie* and the *Physicienne*, which visited Sydney in 1819. Quoy and Gaimard were the naturalists, and, though collections were made during the vessel's stay at Port Jackson, these were lost in a "terrible shipwreck," together with the Australian birds and Papuan butterflies. Only one Australian insect appears to have been saved from the wreck, and this species, a weevil, *Cylydrorhinus lemniscatus* (Quoy and Gaimard, 1825, *Curculio*), was taken at Shark's Bay, West Australia (6a).

In the years 1818-1822 survey work on the Tasmanian and Australian coasts was carried out by Captain Phillip Parker King (son of Philip Gidley King, former Governor of New South Wales), in the *Mermaid* and the *Bathurst*. Allan Cunningham, the botanist, was with King from the time the Expedition left Sydney on 22nd December, 1817, until its termination at the same place on 25th April, 1822, and he collected insects as well as plants.

In 1826 appeared King's *Narrative of the Survey of the Intertropical and Western Coasts of Australia*, and in Appendix B., William Sharp Macleay described the insects collected by the Expedition. Swainson in his *Zoological Illustrations* described and figured some of the species collected by Cunningham. In 1835, Boisduval in the *Magasin de Zoologie* described a new species of beetle, *Ceraegidion horrens*, from North Australia, collected by Cunningham.

In the *Narrative of the Survey*, King (7) makes an interesting record, when at Cleveland Bay, on 16th June, 1819, "Here, as well as at every other place that we had landed upon within the tropic, the air is 'crowded' with a species of butterfly, a great many of which were taken. It is doubtless the same species as that which Captain Cook remarks as so plentiful in Thirsty Sound; he says, 'We found also an incredible number of butterflies, so that for the space of three or four acres the air was so crowded with them that millions were to be seen in every direction, at the same time, that every branch and twig were covered with others that were not upon

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(6a). Described in *Voyage Autour du Monde . . . Exécuté sur . . . l'Uranie et la Physicienne, pendant les années, 1817-20. Publié . . . par M. Louis de Freycinet. Zoologie, par Mm. Quoy et Gaimard, Médecins de l'Expédition, 1825* (on title page, 1824).

(7). Volume i., p. 195.



the wing' (8). The numbers seen by us were indeed 'incredible'; the stem of every grass- tree, *xanthorrhoea*, which plant grows abundantly upon the hills, was covered with them, and on their taking wing the air appeared, as it were, in perfect motion.

"It is a new species and is described by my friend, Mr. W. S. Macleay, in the Appendix, under the name of *Euploea hamata*."

Accompanying the *Mermaid* and the *Bathurst* on their cruises were Frederick Bedwell and John Septimus Roe, assistant surveyors, the latter's name being associated with *Pangonia Roei* Macleay, 1826. Mr. James Hunter, surgeon, was on the *Mermaid* during her voyage from 12th June to 6th December, 1820. *Stratiomys Hunteri* Macleay, 1826, links his name with King's survey. Of the leader we have no less than six of the insects described as new by W. S. Macleay, bearing the specific name of *Kingii*. The genera are *Paecilus*, *Buprestis*, *Megamerus*, *Coccinella*, *Agrion*, and *Macroglossum*.

Among the interesting insects described in the Appendix to the *Survey* is the Spiny Leaf Insect, *Ectatosoma tiaratum* (Macleay, 1826, *Phasma*).

In 1824 the French vessel, *La Coquille*, in command of L. I. Duperrey was at Sydney from 17th January to 20th March. The naturalists to the Expedition were the surgeons R. P. Lesson and P. Garnot, and as they were here at a time of the year when insect life is abundant they amassed a very large collection. The insects were described later by Guérin-Ménéville (9).

In 1824-1826 Baron de Bougainville was in command of an Expedition, consisting of the *Thétis* and *Espérance*, which was at Port Jackson from 30th June to 21st September, 1825. During his stay he erected at Botany Bay a monument to La Perouse. No collections of insects appear to have been made.

In 1826 the *Astrolabe* (formerly known as *La Coquille*) under the command of Dumont d'Urville, visited Australia, passing along the coast from King George's Sound to Port Jackson and spending some time at Western Port. New Zealand and the islands of the Western Pacific and Malaysia were visited also. In 1828 the vessel was at the Island of Vanikoro, where relics of La Perouse's ill-fated Expedition were secured.

The insects collected were described by Boisduval (10).

In the last decade of this period settlements were founded at various points along the coast and some of these, such as Melville Island (1824-1829), Western Port (1826-1828), and Raffles Bay (1827-1829) soon faded into obscurity, but others such as Moreton Bay (1825), Albany (1826), Swan River (1829) remain with us to this day. From these settlements Expeditions set out to explore the interior of the great continent.

In 1827 the Colonial Museum, afterwards called the Australian Museum, was founded. William Holmes was the first custodian under the title of Colonial Zoologist.

(8). Hawkesworth, Vol. iii., p. 125.

(9). In Duperrey's *Voyage Autour du Monde . . . sur . . . La Coquille, pendant les Années, 1822-1825*. The plates, with the scientific names of the insects, appeared between 1827-1832, but the text did not appear until 1838. In 1842, Guérin-Ménéville published a paper in the *Magasin de Zoologie* on the Thynnides.

(10). In Dumont d'Urville's *Voyage de Découvertes de l'Astrolabe . . . pendant les Années, 1826-1829*, under the title of *Faune Entomologique de l'Océan Pacifique*, etc., the part treating with the Lepidoptera appearing in 1832 and the part containing the account of the Coleoptera and other Orders in 1835.



## THE WESTWOODIAN PERIOD: 1831-1861.

This period was characterized by land exploration, and most of the insect material collected was determined by specialists in England, among whom John Obadiah Westwood stands pre-eminent.

This great entomologist was intended for the law and was admitted as a solicitor and became partner in a firm, but Entomology proved too absorbing a study, and, having private means, he was able to devote himself whole-heartedly to his favourite pursuit. To his love of Entomology he added a talent for drawing, and his *Arcana Entomologica* and *Thesaurus Entomologicus Oxoniensis* stand as monuments to his ability as an entomologist and a draughtsman. His friend and patron was the Rev. F. W. Hope, a wealthy amateur and a describer of Australian insects. In 1858, Hope "presented his collections to the University of Oxford, combined with that of Westwood himself, which he purchased, and endowed a Professorship, which Hope intended should be of Entomology, but a difficulty was thrown in the way, and a compromise was effected by instituting a Chair of Invertebrate Zoology. Westwood was the first Hope Professor" (11). His first paper was published in 1827 and his last in 1889, representing 62 years of entomological research—surely a record. Such was the man whose name I have chosen to represent this period.

Among the Expeditions which explored the hinterland of New South Wales during this era were those organised by Major (afterwards Sir) Thomas L. Mitchell, Surveyor General.

In 1831-32 he made a journey in search of the "Kindur River," exploring as far as the Karaula or Macintyre River; in 1835 he explored the course of the Darling River for 300 miles, and in 1836 led an expedition to the Darling and Murray Rivers.

Accounts of these three Expeditions were given by him in two volumes, published in 1838.

On his first Expedition he describes the effects of an attack upon him by a wasp having "passed near a tree on which their nest was suspended," and which in a footnote he describes as Genus *Vespa*, subgenus *Abispa*, species *Abispa Australiana*. This well known yellow and black "Mud dauber" wasp is now known as *Abispa ephippium* (Fabricius, 1775, *Vespa*), the subgenus having been raised to generic rank and the specific name sunk as a synonym. Smith (12) points out that the "passage in 'Mitchell's Expedition in Eastern Australia' (Vol. i., p. 104) can hardly refer to this species, as it appears to have been some gregarious wasp by which the travellers were attacked." Apart from a few species mentioned in his work, this was the only record of note.

In 1831, the corvette *La Favorite*, under the command of M. Laplace, visited Hobart during July and August, and Port Jackson in August and September. Owing no doubt to the fact that the Expedition was in Australian waters during the winter months, the number of insects recorded is small. The insects were described by Guérin-Ménéville (13).

(11). Obituary by R. McLachlan.—Professor John Obadiah Westwood, M.A., F.L.S., *Ent. Mo. Mag.* (2), iv., February, 1893, pp. 49-51.

(12). F. Smith, *Trans. Ent. Soc. Lond.* (n.s.), i., 1851, p. 181.

(13). In Laplace's *Voyage autour du Monde . . . sur la Favorite . . . pendant, 1830-32*, in Vol. v., Zoologie, pt. 2, in 1838, and the new Lepidoptera, by Baron de Feisthamef, in a Supplement to the Zoologie in 1839. The new species were also described and figured in the *Mag. de Zoologie* for 1838-1839.

In 1836, the great naturalist, Charles Darwin, on his voyage round the world, visited our shores in *H.M.S. Beagle*, under the command of Captain Fitzroy. He arrived at Sydney on 12th January, and on the 16th left for Bathurst, arriving there on the 20th and commencing his return journey on the 22nd. The *Beagle* left for Hobart on the 30th January, arriving on 5th February, and spending two days there, during which time Darwin ascended Mount Wellington. King George's Sound was reached on the 6th March, and here, eight days were spent, the *Beagle* leaving on the 14th. The dates are taken from his well known "Journal," which was first published in 1839. Conditions could not have been congenial, as Darwin's words of farewell were, "I leave your shores without sorrow or regret." During his travels in Australia and Tasmania, Darwin collected insects, and many of these are described by G. R. Waterhouse (1838-1839); Babington (1842); Saunders (1843). *Foenus Darwinii* Westwood, 1841; *Alleloplasis Darwinii* G. R. Waterhouse, 1839; *Hydroporus Darwinii* Babington, 1842; *Ideocephala Darwinii* Saunders, 1843, are Australian insects, which carry the name of our distinguished visitor.

During the years 1837-1843, *H.M.S. Beagle* explored and surveyed the coasts and rivers of Australia, Captain J. C. Wickham and later Captain J. Lort Stokes carrying on the work which had been begun by Captain P. P. King. Stokes in his work (14) furnishes an appendix to volume I., in which Adam White describes and figures the Coleoptera collected, and Edward Doubleday treats with the Lepidoptera.

From March 27 to April 5, 1839, the French corvettes, *Astrolabe* and *Zélée*, were at Raffles Bay, from whence they went to Port Essington (Victoria Town), which they left, for Aru Islands, on April 9. In December, 1839, and February, 1840, they visited Hobart, en route to and from the Antarctic.

Dumont D'Urville was in command of the Expedition, and the naturalists were Mm. Hombron (Surgeon-major of the *Astrolabe*) and Jacquinot (Captain and commandant of the *Zélée*). Le Guillou (Surgeon-major of the *Zélée*), later published descriptions of a number of Tasmanian and Australian insects in the *Magasin de Zoologie* (1841, 1842, 1844), but his name is not so well known as those of the famous pair, Hombron and Jacquinot.

The account of the Expedition, *Voyage au Pole Sud et dans l'Océanie sur les corvettes l'Astrolabe et la Zélée; pendant les Années, 1837-1840*, was published under the direction of Jacquinot; the *Histoire du Voyage* being from the pen of Dumont D'Urville, and the *Description des Insects*, by Emile Blanchard, appearing in the *Zoologie*, tome. iv., 1853. Many species of insects were recorded from Raffles Bay, N. Australia, and Tasmania.

This was the last of the great French Expeditions, and, while their visits to the Pacific added but little to French colonial possessions, the value of the scientific work carried out was great, and Australian zoology has benefited considerably for their coming. Magnificent volumes of scientific results, lavishly illustrated and which have never been equalled, remind us of the part France has played in the history of our Continent.

The visit of Dumont D'Urville, in the *Astrolabe* in 1826, led to the foundation of such settlements as Western Port (1826) and Albany (1829), with a view of anticipating any attempts at colonization by France. Lord John Russell in after years related that "during my tenure of the Colonial office, a gentleman attached to the French Government called upon me. He asked how much of Australia was claimed as the Dominion of Great

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(14). *Discoveries in Australia; with an account of the Coasts and Rivers explored and surveyed during the Voyage of H.M.S. Beagle in the years 1837-1843, etc.*, published in two volumes, in 1846.

Britain. I answered, 'The whole,' and with that answer he went away" (15).

During 1837-1839, Captain George Grey led two Expeditions of exploration into North-west and Western Australia, and in an appendix (cited on p. 189, footnote 1), Adam White described some species collected at King George's Sound.

In 1840-1841, Edward John Eyre carried out exploratory work in Central Australia, and, accompanied by an aboriginal, made his way overland from Adelaide to King George's Sound. On his travels he collected insects, and in an Appendix to Vol. ii. of his account of his Expeditions (16), Adam White described and figured four new species of Australian insects, and Edward Doubleday, *Description of some new Australian Lepidopterous Insects*.

During this period, Mrs. Charles Meredith, an Englishwoman, arrived in New South Wales on 27th September, 1839, and in January, 1840, settled at Homebush, near Sydney. In 1844, she published, in London, a little book entitled, *Notes and Sketches of New South Wales during a Residence in that Colony from 1839 to 1843*. In October, 1844, she and her husband went to reside in Tasmania, and here she did all that lay within her power to popularise the study of Natural History. She published several books, providing the illustrations herself, and among these may be mentioned *My Home in Tasmania during a Residence of Nine Years*, 2 vols., 1852; *Some of My Bush Friends in Tasmania*, in two series, 1869-1891, with 11 and 12 coloured plates, and *Tasmanian Friends and Foes, Feathered, Finned, and Furred*, 1881. Additional interesting information is given about her by the late J. J. Fletcher in the second part of his Address, and by Miss Margaret Swann, in the *Journal and Proceedings of the Royal Australian Historical Society*, xv., 1929, pp. 1-29.

On the 1st October, 1844, Dr. Ludwig Leichhardt left Jimbour, Darling Downs, to find a way overland to Port Essington. On his way he discovered the Dawson, Mackenzie and other rivers, and followed a stream which he called the Lynd to its junction with the Mitchell River. On 28th June, 1845, Gilbert, the naturalist, was killed by the aborigines. On the Roper River the botanical collections had to be abandoned. On 17th December, 1845, the Expedition reached Port Essington.

*Amycterus Leichhardtii* Macleay, 1865, from the Lynd River, N. Australia, recalls this Expedition.

In 1845, Mitchell set out from Boree, near Orange, to find a route from New South Wales to the north-west coast. After some months of travel he came to a stream running north-west and which he imagined was the head stream of the Victoria River whose mouth is on the north-west coast 1,200 miles away, and called it by this name. He then returned to Sydney. This river was found by Kennedy in 1847 to be the Barcoo or Cooper's Creek.

Among the insects collected by Mitchell on this Expedition are two Amycterid weevils, *Psolidura Mitchelli* Macleay, 1865, and *Talaurinus Mitchellii* Macleay, 1865.

The establishment of the settlements soon began to have an influence on Australian Entomology, so that in scientific journals their names as localities of insects collected commenced to appear.

References to Melville Island species are given by G. R. Gray (1834-

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(15). Russell's *Recollections and Suggestions* (1875), p. 203, teste E. Scott's *Terre Napoléon*, p. 277.

(16). *Journals of Expeditions of Discovery into Central Australia and overland from Adelaide to King George's Sound. In the years 1840-1841, etc. (1845).*



1837), Shuckard (1841), Bainbridge (1842), Westwood (1842), Hope (1845), and to Port Essington species by Hope (1842, 1845, 1848), Westwood (1842-1851), Saunders (1842), and Adam White (1858).

During the Westwoodian Period settlements were formed at Twofold Bay, New South Wales, in 1834, and Portland Bay, Victoria, in 1835.

In 1836, South Australia was founded, Adelaide receiving its name the following year. Among early collectors of insects in South Australia were A. H. Davis (1841), C. D. E. Fortnum (1843), G. F. Angas (1847), who wrote and illustrated a fine work, *South Australia Illustrated*, in which he gives three plates of insects and describes several as new. Dr. Behr (1847), also wrote several papers on the insect fauna of South Australia.

In 1835, John Batman and John Pascoe Fawkner settled on the River Yarra at the head of Port Phillip, and in 1837 Melbourne received its name. It was not, however, until 1851 that the Port Phillip district was constituted the colony of Victoria. Until this desirable state of affairs came about, entomologists were at a loss to know in which State Port Phillip was situated and some of their attempts to locate it, for the insects they record from this locality, are rather amusing from an Australian point of view. Westwood in his *Arcana* placed it in West Australia, and Newman in South Australia and again in New South Wales.

The first Port Phillip insects to be named appear to be those collected by Edmund Thomas Higgins, which were described by Edward Newman (1842, 1850) and Westwood (1842). Insects had been collected at Western Port during the visit of the *Astrolabe*, and, as this locality is so close to Port Phillip, therefore it should be credited with yielding the first insects of the district. In 1839, Dr. Godfrey Howitt arrived in Melbourne, and there made a large collection of insects, which were named by specialists in England; he was regarded as the foremost entomologist in Victoria for many years.

In 1840, Angus McMillan discovered Gippsland, and in the same year Count Strzelecki explored it, and while en route ascended the highest peak of the Munlong or Snowy Ranges, which he named Mount Kosciusko.

In 1842, Moreton Bay was opened to free settlers, but it was not until 1859 that Queensland was created a separate colony.

During the years 1855-1856 an Expedition, under the leadership of A. C. Gregory, landed near the mouth of the Victoria River, North Australia, and investigated the country in a west-easterly direction. A look-out was kept for traces of Dr. Leichhardt's Expedition, which had been last heard of in April, 1848. With the party as botanist was Dr. Mueller, afterwards Baron von Mueller, while Dr. J. R. Elsey acted as surgeon and naturalist. Insects collected by both naturalists were described by Adam White (16a), *Catadromus elseyi* and *Oryctes mulleranus* recalling the Expedition, an account of which was published later by the leader (16b).

In 1855, Van Diemen's Land was renamed Tasmania. During this Period several entomologists settled in Tasmania, and among them was Thomas Winter, who wrote a letter on the entomological peculiarities of Van Diemen's Land; extracts from this letter were communicated to the *Entomological Magazine*, ii., 1835, by William Swainson. Other collectors of Tasmanian insects were R. H. Lewis and T. J. Ewing.

In the years 1857-1859 the Austrian Frigate *Novara*, under the Com-

(16a). Adam White, *Proc. Zool. Soc. London*, Part xxvii., 1859, for March 8, 1859, pp. 117-123. *Annulosa*, pl. lviii.-lix.

(16b). A. C. Gregory, *Journal of the North Australian Exploring Expedition*, 1855-1856. In A. C. Gregory and F. T. Gregory, *Journals of Australian Exploration*, 1884, pp. 99-194.



modore B. von Wullerstorf-Urbair, voyaged round the world, and was at Sydney from 5th November to 7th December, 1858. A large number of insects was taken during the ship's stay (17).

During 1858-1868 the Swedish Frigate *Eugenie*, under the command of C. A. Virgin, was on a round the world cruise, and was at Sydney from the 22nd to 31st October, 1852, and here collections of insects were made (18).

#### THE MACLEAYAN PERIOD: 1862-1929.

In 1862 the Entomological Society of New South Wales was founded by Sir William Macleay, and much valuable work was published in the Transactions of the Society, in the two volumes which appeared during the years 1863 to 1873. This latter year marked the end of the Society, but its place was very competently filled by the Linnean Society of New South Wales in the following year. This Society was and still is maintained chiefly through the liberality of Sir William Macleay.

This great patron of science in New South Wales came to Australia in 1839, and after spending some years as a sheep-farmer entered politics. In 1875 he organised the *Chevert* Expedition which investigated the fauna of New Guinea and Torres Straits. His collections, together with those made by his uncle, Alexander Macleay, and his cousin, William Sharp Macleay, are housed in the Macleay Museum, at the University of Sydney, where they are in a more or less satisfactory state of preservation. Sir William Macleay also did much to further the collecting of entomological specimens by sending into the field such well known workers as the late George Masters and Mr. W. W. Froggatt. The former collector afterwards became the Curator of the Macleay Museum.

At their beautiful home, Elizabeth Bay House, on Sydney Harbour, the Macleays extended hospitality to those interested in Natural Science, and many overseas visitors have written in the most glowing terms of their visits to this sylvan retreat, now one of Sydney's most populous suburbs.

At an annual meeting of the Entomological Society of New South Wales, Sir William Macleay chose as the subject of his Presidential Address "a brief summary of the earlier history of Australian Entomology," but, as he dealt with only a few papers up to 1862, I make no apology for covering part of the same ground.

A member of the Entomological Society of New South Wales whose name will long be remembered by his work was Alexander Walter Scott, a lepidopterist, who followed in the footsteps of Lewin by investigating the life-histories of Australian Lepidoptera, which were beautifully recorded in colour by his daughters, Harriet (Mrs. Crosby W. Morgan) and Helena (Mrs. Edward Forde) (19).

(17). *Reise der Oesterreichischen Freggate Novara um die Erde, in 1857-1859*, etc. Zoologischer Theil., 2 Bd., 4to. Wien., 1864-1875.

(18). *Kongliga Svenska Fregatten Eugenie's Resa omkring jorden*, under befäl af C. A. Virgin, åren, 1851-1853. Vetenskapliga iakttagelser . . . utgifna af K. Svenska Vetenskaps-Akademien. 2 Vol., illustr., 40. Stockholm and Uppsala, 1857-1910. Vol. ii., Zoologi. 1.; Insecta, 1858-1868.

(19). *Australian Lepidoptera and their Transformations, drawn from the Life by Harriet and Helena Scott; with Descriptions, General and Systematic*, by A. W. Scott, M.A., Ash Island, Hunter River, New South Wales, Vol. i., pts. i.-iii., London, 1864. In 1890-1893, the Trustees of the Australian Museum, who had acquired the unpublished matter after the death of Scott, published in Sydney, with an amended title, Volume ii., pts. i.-iv., and which was edited and revised by Helena Forde and Arthur Sydney Olliff.

During this period the great trading firm of Caesar Godeffroy und Sohn had established at Hamburg the Godeffroy Museum, and in the scientific publication which they issued, *Journal des Museum Godeffroy*, papers were published on the Natural History of the Pacific. The collections of this Museum later were sold to other Museums. Among the collectors sent out by this Museum was Frau Amalie Dietrich, who arrived in Australia in 1863 and returned to Hamburg in 1873. Most of her time here was spent in Queensland, and she collected at Brisbane, Rockhampton, Bowen, and Port Mackay. *Nortonia Amaliae* Saussure, *Odynerus Dietrichianus* Saussure, and *Bubo Dietrichiae* Brauer, 1870, are insects which bear the name of this energetic collector.

Herr E. Dämel also collected for the Godeffroy Museum. He was in Australia during the years 1852-1860, 1866, 1871-1875, and he sent also material to Sir William Macleay. In his quest for specimens he visited Gayndah, Peak Downs, Port Curtis, Port Denison, Rockhampton, Cape York, Sydney, and West Australia. *Ialmenus Dameli* Semper, 1879, *Nyctozoilus Daemeli* Haag-Rutenberg, 1878, *Laonicus Daemeli* Haag-Rutenberg, 1878, *Mecynognathus Dameli* Macleay, 1873, are among the insects secured by him in Australia.

Among those who have left their imprint on the pages of Australian Entomology is Count Castelnau (F. L. de Laporte), a widely travelled man, who arrived in Melbourne in 1862 and died there in 1880. He is best known as a collaborator with Gory in their splendidly produced work, *Histoire Naturelle et Iconographie des Insectes Coleoptères*, published in Paris, in four volumes, in 1835-1841, and in which are described and figured a great number of our Australian Buprestidae. During his residence in Australia he published a number of papers on Coleoptera and on Fishes.

In 1891, Sir Thomas Elder organised an Expedition which "left Warrina, on the Great Northern Railway, 633 miles from Adelaide, with the intention of exploring the country to the westward, lying between the parallels of 27 deg. and 29 deg. However, the unfavourable character of the season prevented the instructions of the promoter being carried out, and the only new country passed over was on the traverse from Cavenagh Range to Victoria Spring. On reaching Annean Station, in the Murchison District, of W. Australia, in January, 1892, the party was recalled." The above information appears in a Preface to the Scientific Reports which appeared in the *Transactions of the Royal Society of South Australia*, xvi., 1892. The entomologists who contributed to these reports were Lower (1892), Blackburn (1892 & 1893), Froggatt (1893), Tepper (1893), Sloane (1893).

In 1894, William Austin Horn, member for Flinders in South Australia, fitted out an Expedition to investigate the country between Oodnadatta and Macdonnell Ranges.

A number of insects was collected on this Expedition; these are described in the first two parts of the *Report of the Work of the Horn Scientific Expedition to Central Australia*. Edited by Baldwin Spencer, 4 pts., illustr., 4to., London, Melbourne, 1896.

In 1905 a German Expedition collected a number of animals, including insects, in South-west Australia, which later were described by specialists, in the finest work on the Insect Fauna of West Australia yet produced (20).

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(20). *Die Fauna Südwest-Australiens. Ergebnisse der Hamburger süd-west-australischen Forschungsreise, 1905*, herausgegeben von Prof. Dr. W. Michaelsen und Dr. R. Hartmeyer. Bds., i.-ii., 1907-1910.

Among the outstanding Australian workers of this period is Mr. A. M. Lea, Entomologist of the South Australian Museum, a most prolific writer on the Order Coleoptera, a group which comprises nearly half the known species of Australian insects, and he has described more new species than any other worker, completely eclipsing in point of numbers those described by the Rev. Thos. Blackburn.

Dr. R. J. Tillyard has produced a great number of papers on Neuropteroid insects and on fossil forms. In 1917 appeared his book, *The Biology of Dragon Flies (Odonata or Paraneuroptera)*, Cambridge, and in 1926, *The Insects of Australia and New Zealand*, Sydney, a splendidly produced work.

During 1910-1913 a party, under the leadership of Dr. E. Mjöberg, collected in Queensland and North-western Australia. A large number of insects was collected, which have been described by specialists (20a).

The first official Economic Entomologist in Australia was Mr. Charles French, senior, Government Entomologist of Victoria, according to Mr. W. W. Froggatt's Presidential Address (21); French was appointed in 1889 and retired in 1911 after twenty-two years of service. This veteran entomologist has done much to advance the science of Entomology in Australia. His work in the past was economic rather than taxonomic, and his best known publication is his *Handbook of the Destructive Insects of Victoria*, parts i.-v., illustrated in colour, by Mr. C. C. Brittlebank.

His eldest son, Mr. Charles French, junior, now fills the position of Government Entomologist.

Mr. A. Sidney Olliff was the first Government Entomologist in New South Wales. When the late Dr. E. P. Ramsay, Curator of the Australian Museum, was in London, in 1883, he selected Mr. Olliff as Entomologist of the Australian Museum, and he arrived in Sydney to take up his duties in February, 1885, and served in the capacity of Entomologist to the Museum for five years. In 1890 he resigned to take up his duties as Economic Entomologist, and he held the position until his death in December, 1895.

Mr. Walter Wilson Froggatt, who was appointed his successor in the following year, has been an energetic worker on Economic and Systematic Entomology, his output of papers being probably greater than any other Australian worker. These have appeared chiefly in the *Agricultural Gazette of New South Wales*, and the *Proceedings of the Linnean Society of New South Wales*, and *The Australian Forestry Journal*, and, as they have been illustrated for the most part by trained artists, such as Chambers, Grose, Zeck, and Miss E. King, the value of his work is enhanced accordingly. In 1907 his *Australian Insects* appeared, a work now out of print, but which was the first popular general guide to our insects. In 1923 he retired from the Agricultural Department, but served for four years in the Forestry Department, and published a number of papers in the *Australian Forestry Journal*, which later provided material for a book on forest insects.

His place in the Agricultural Department is now held by Mr. William B. Gurney.

The History of Economic Entomology in the other Australian States is given by Mr. Froggatt in his Presidential Address.

Of recent years Entomological Research has received considerable impetus, particularly in Queensland, where Sugar Experiment Stations officered

(20a). See Results of Dr. Mjöberg's Swedish Scientific Expeditions to Australia, 1910-1913. *Kungl. Svenska Vetenskapakademiens Handlingar*, Bd. 52, and in *Arkiv. för Zoologi*.

(21). W. W. Froggatt, *Proc. Linn. Soc. N.S. Wales*, xxxvii., 1912, p. 19.



by their own entomologists have been established to combat pests of the sugar cane. In the Agricultural Department in Brisbane, where in the past Mr. Henry Tryon was the only entomologist, quite a large entomological staff is now employed. Though all the States cannot show the same progress as the great tropical State, still headway is being maintained. The establishment of Prickly Pear Laboratories in Queensland and near Moree, New South Wales, under the supervision of entomologists trained at a central laboratory, Sherwood, Queensland, to study the habits of those insects introduced to attack the pear have also done much to advance the Science in Australia.

So colossal are the entomological problems which face the economic entomologist in Australia that the Commonwealth Government, through the Council for Scientific and Industrial Research appointed, in 1928, Dr. R. J. Tillyard, as Chief of the Division of Entomology.

In the Second Annual Report of the Council for Scientific and Industrial Research for the year ended 30th June, 1928, p. 18, it is stated that "the lines of research that will be undertaken will be mainly those delimited by the broad term 'methods of biological control.' They may, therefore, be divided into the two following types:—

"(a) The control of insect pests by beneficial parasites or predators; and

"(b) The control of noxious weeds by their natural insect enemies.

"Among the noxious insects, he (Dr. Tillyard) suggests that attention should be given to the sheep blowfly, buffalo fly, pests of orchard and fruit crops, such as thrips, the lucerne flea and pea mite, the underground grass-grub of Tasmania, and certain insect pests of forests."

These problems, which have occupied the attention of many entomologists in the past, are of such magnitude that much time will elapse before we can expect panaceas.

In bringing my Address to a close, I may be permitted to recapitulate briefly the History of Entomological Research in Australia.

In the early Fabrician Period, collectors like Banks and Solander submitted their gatherings to entomologists such as Fabricius, who named all their insects. Then followed the great French Expeditions whose naturalists made large collections which were taken to France and the results published in magnificent volumes. These gave way to the land explorer and the settler, who sent the insects they had secured overseas to workers such as Adam White and Westwood, who issued the descriptions of them in British and Continental scientific periodicals. At a more recent period Australian workers are describing new forms in scientific journals, published locally.

The all-round entomologist now seems to have disappeared almost entirely, having given way to the specialist, and so we find institutions such as the Division of Entomology at Canberra, with large staffs concentrating on single entomological problems.

What does the future hold in store? Taxonomy is an ever-present problem, as the numbers of species of insects are so great and steadily increasing that to identify them or to find names for them is now no easy task, and involves increasing researches into literature and careful analysis of species and redescription of old types. The literature, too, has increased to such an extent since the days of Fabricius that the Australian worker without access to large libraries is at a complete loss. The problem of storing, cataloguing and indexing literature is an acute one, and scientific works are, as a rule, expensive.

I do not claim to have given you a tithe of the names of the entomolo-



gists who have described our insects; at best I have given you an outline of the History of Australian Entomological Research, but I hope that at some future date I may be able to place before you a Bibliography of Australian Entomological Literature so that you may gain some idea of the extent of the entomological work produced during the past 155 years.

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### THE CICADA BIRD.

(*Edolisisoma tenuinostre*.)

By NORMAN CHAFFER.

Plate xvii.

For quite a considerable period during my early bird observing trips I was puzzled and intrigued by a strange bird call. It was unlike the notes of any birds of my acquaintance and bore a considerable resemblance to the drumming of a Cicada. Starting moderately loud, the frequently repeated notes would gradually swell in volume and then suddenly cease. The performance would be repeated several minutes later. The singer, too, was rather difficult to locate as the call had quite a ventriloquial quality. One could not be sure that the bird was close at hand or some distance away. The call, too, carried well, and could quite easily be heard a quarter of a mile from the singer. I later found that the author of the call was the Jardines Caterpillar eater or Cicada bird, and that the loud repeated notes were those of the male.

A considerable difference in coloration exists between the two sexes. The male is of a general slate grey colour. The side of the face is black and the wing quills black, edged with grey. The outer tail feathers are black, tipped with grey, and the inner feathers slate grey, with a black spot near the end and a grey tip. The approximate length of the bird is 9½ inches. The female is brownish grey above, with the wing feathers edged lighter. The face is blackish; the tail dark brownish grey edged whitish. The under surface is light greyish brown, indistinctly barred with blackish.

The Cicada bird occurs along the northern and eastern portions of Australia, showing a preference to thickly timbered hillsides, near the sea. It keeps to the topmost branches of the trees, where it secures the insects, which constitute its food. But for the loud note it would often be passed by unnoticed. About Sydney it is migratory in habit, arriving here in October. Cicadas form one of its favourite foods, and at times it appears to subsist almost entirely on these insects.

Compared with the size of the bird, the nest is one of the smallest of any of our birds, being only three inches wide by two inches deep outside, and two inches wide by a half inch deep inside. It is composed of bark and twigs, and decorated on the outside with pieces of bark and lichen. The nest is admirably camouflaged, closely resembling the branch on which it is built. Placed at a considerable height from the ground, it would be almost impossible to find other than by watching the bird's movements. I have never seen more than one egg recorded for a clutch. However, I once noted two young birds away from the nest being fed by a pair of adults. The egg is of a greenish ground colour, blotched with brown. The male helps largely in the nest building and rearing of the young. On the 18th December, 1927, a nest was found in course of construction about thirty feet from the ground in a turpentine tree. The male only brought material to the nest during a period that the nest was under observation.

The photograph (Plate xvii.) was taken on the 30th November, 1929, at Avalon, a seaside resort near Sydney. The nest found by Mr. Rhodes was visited under the guidance of Mr. Basset Hull and Mr. Iredale. It was situated some fifty feet from the ground, on the horizontal branch of an ironbark tree. After a strenuous climb the camera was hauled up and with a good deal of trouble lashed into position some six feet from the nest. During these operations the female repeatedly flew past, snapping her bill at me. I retired some distance down the tree with a string on the shutter release. A couple of times the female approached with food, but would not face the camera. After half an hour's wait the male turned up, and with considerable uncertainty and hesitation approached the nest. Once there, however, he took but little notice of the camera, and stayed around for some minutes. I paid another visit to the nest a week later, but again the female was very shy and refused to approach during the couple of hours the camera faced the nest. During this period the male visited the nest on one occasion only.

## THE BEES OF AUSTRALIA.

By PROFESSOR T. D. A. COCKERELL.

University of Colorado, U.S.A.

(Continued from p. 156.)

## MEGACHILIDAE.

The Australian genera of Megachilidae are few, and may be separated by the following table:—

- |   |                                |
|---|--------------------------------|
| Eyes hairy; apex of abdomen pointed in female, denticulate or spinose in male; bees parasitic in nests of <i>Megachile</i> ..   | <i>Coelioxys</i> Latreille.    |
| Eyes not hairy; abdomen otherwise formed ..   | 1.                             |
| 1. Small bees with yellow tegumentary markings ..   | <i>Anthidiellum</i> Cockerell. |
| Without light tegumentary markings ..   | 2.                             |
| 2. Female without a ventral scopa (brush of hairs for collecting pollen); female antennae 13 jointed and anterior coxae spined, as in male of <i>Megachile</i> ..   | <i>Androgynella</i> Cockerell. |
| Female with a ventral scopa ..  | 3.                             |
| 3. Apical part or all of male flagellum very slender, but the extreme apex abruptly broadened and clavate or spatulate; female similar to <i>Megachile</i> of the <i>M. heriadiformis</i> group ..                      | <i>Thaumatosome</i> Smith.     |
| Male antennae not thus modified ..  | 4.                             |
| 4. Marginal cell sharply pointed; face in female with a protuberance; feet with pulvilli (pads between the claws) in some species, but in others they are not apparent; end of male abdomen with a small sharp point .. | <i>Lithurgus</i> Berthold.     |
| Marginal cell obtuse; feet without pulvilli ..  | <i>Megachile</i> Latreille.    |

## COELIOXYS Latreille.

These hairy-eyed parasitic bees have been separated as a subfamily Coelioxynae. They are presumed to have evolved from some ancestral form of nest-building Megachilidae, but certainly not from any genus now living. It has been held that the Megachilinae and Anthidiinae were without hair on the eyes, but I have just described a new subgenus *Trichanthidium* for a remarkable little bee, *Pachyanthidium occipitale*, possessing abundant hair on the eyes. It was discovered by Michael Bequaert in the Katanga district, Belgian Congo. Only the female is known, recognisable in that fauna by the abdominal markings greatly reduced or nearly obsolete, the first two tergites all black, and the sharp elevated rim of the occiput.

*Coelioxys* is extremely abundant and varied in South America, but the species in Australia and the Malay region are few. This is rather surprising, considering the great abundance of *Megachile*. We must infer, I think, that *Megachile* reached Australia at a very early date, but *Coelioxys* much later.

The recognition of this genus is facilitated by the good figures of both sexes of *C. froggatti*, published by Mr. T. Rayment, in Victorian Naturalist, July, 1929.

The following key separates the Australian species:—

- |  |                          |
|--|--------------------------|
| Apical margin of scutellum emarginate in middle; male with apical segment of abdomen longer than broad, with six well-developed teeth, the lateral ones spine-like; female with last ventral segment not notched at sides .. | <i>albolineata</i> Ckll. |
| Apical margin of scutellum not emarginate ..   | 1.                       |
| 1. Wings extremely dark, brilliantly violaceous; head with much white hair; lateral teeth of apical segment of male abdomen rudimentary ..   | <i>weinlandi</i> Schulz. |

- Wings, if dark, not so violaceous; head, if white-haired, less conspicuously so; lateral teeth of apical segment of male abdomen well developed . . . . . 2.
2. Larger; wings darker; last ventral segment of female abdomen deeply notched on each side; abdominal hair-bands lateral only . . . . . *reginae* Ckll.
- Smaller; length of female hardly 10 mm., of male 7.5; last ventral segment of female abdomen barely notched; white abdominal bands entire or very slightly interrupted; scutellum with two large white hair spots, sometimes absent . . . . . *froggatti* Ckll.

*Coelioxys albolineata* Cockerell.

Originally described from a female a little over 9 mm. long, collected by Turner near Mackay, Queensland. Turner also collected it at Kuranda, and Hacker reports it from Brisbane. It is an isolated species on the Australian fauna, but has relatives in New Guinea (*C. biroï* Friese) and the Solomon Islands (*C. dispersa* Ckll.). *C. albolineata* var. *darwiniensis* Cockerell, 1929, from Port Darwin, has the mesothorax dark red, black along hind margin, and the legs red.

*Coelioxys weinlandi* Schulz.

*C. albiceps* Friese is a later name for the same insect. It was collected by Beccari in the Aru Archipelago in 1873, but is known to occur in Queensland, at Cape York (Froggatt) and Kuranda (Turner). It is a comparatively large species, the females about 16 mm. long, the males about 10 to 12.

*Coelioxys reginae* Cockerell.

The type, a female a little over 11 mm. long, was collected by Turner near Mackay.

The species ranges north to Port Darwin, and south to the vicinity of Brisbane.

*Coelioxys froggatti* Cockerell.

Originally collected by Froggatt in Victoria, it is known to go south to Tasmania, and west to Yallingup, W.A. It appears to be the only member of the genus in southern Australia.

Although it is probable that few, if any, additional species will be found in Australia, there is a good opportunity for biological observations, connecting these bees with their *Megachile* hosts.

*Anthidiellum* Cockerell.

This genus, representing the Anthidiinae in Australia, occurs only in the far north, and must be regarded as a relatively recent intruder from the Austromalay region. There are two species.

Tegulae red; scutellum with a very broad orange band, interrupted in middle . . . . . *turneri* Friese.

Tegulae and scutellum black; a very small species, the male hardly 5 mm. long . . . . . *melanaspis* Ckll.

*Anthidiellum turneri* Friese.

Described in 1909 from specimens collected by Turner near Mackay (Ann. Mus. Hung., vol. 7, p. 257). It is omitted from Hacker's Catalogue.

*Anthidiellum melanaspis* Cockerell.

I found this on Thursday Island, March, 1928 (Ann. Mag. Nat. Hist., July, 1929, p. 145). It is related to *A. biroï* (Friese), from New Guinea.

*Lithurgus* Berthold.

This genus is not very close to *Megachile*, notwithstanding its superficial similarity. It is known as a fossil (*L. adamiticus* Heer) from the miocene of Baden. In Tillyard's great work on the insects of Australia and



New Zealand, it is stated that *Lithurgus* is parasitic on *Xylocopa*, but this is a mistake, probably due to the *Lithurgus* breeding in the same posts as the carpenter bees.

*Lithurgus rubricatus* Smith.

Recognised by the bright red hair at apex of abdomen. Smith described it from "New Holland," but Turner collected it in the vicinity of Mackay.

*Lithurgus cognatus* Smith.

Champion Bay, W. Australia. This has been treated as a synonym of *L. rubricatus*, but it may be separable. Smith remarks that both sexes are considerably larger than *L. rubricatus* (the female is said to measure  $7\frac{1}{2}$  lines), and the bituberculate elevation on the face is much more developed. Still, he adds, it may be only a finely developed form of *L. rubricatus*.

*Lithurgus dentipes* Smith.

Based on a male, five lines long, from "New Holland." I saw the type in the British Museum, and noted that it resembled *L. atratus* Smith in having the second recurrent nervure joining the second cubital cell at end, but not quite meeting the intercubitus. It is closely allied to *L. atratiformis*, but has the hair of face pale yellow, and that of sides of thorax brownish grey. In male *L. atratiformis* the hair of the face is all white, that of the pleura all black (except a very little white hair in front), the black hair at sides of sixth tergite is scarcely half as long, and the marginal cell is much more sharply pointed.

*Lithurgus atratiformis* Cockerell.

Described from the N.W. coast of Australia, but since found to be common in Queensland. The hair of apical segment of female is black, the extreme apex dark ferruginous. It is larger (female about 14 mm.) and more rugose than the Indian *L. atratus* Smith.

The genus *Lithurgus* is widespread over the world, in both hemispheres, but for some reason not explained, it is nowhere rich in species.

*ANDROGYNELLA* Cockerell.

This genus is of unusual biological interest. It was based on a species, *A. detera* (Cockerell), obtained by Turner at Mackay and Kuranda, and first placed in *Megachile*. This *A. detera* is in most respects a veritable *Megachile*, but in the female (confirmed by the examination of a long series) there is no ventral scopa, the anterior coxae are spined, and the antennae are 13-jointed. The female seems to have dropped her secondary sexual characters and assumed those of the male, which were present in her genetic constitution. The sting, however, is retained. Such an insect must necessarily be parasitic, doubtless in nests of *Megachile*, and we seem to see how parasitism in bees originated. Recently I found that I could not separate male *Megachile ciliatipes* Ckll. from Brisbane, from *A. detera*. It remains to be seen whether *M. ciliatipes* has a normal *Megachile* female, and is the species from which *A. detera* was derived.

In 1918 (Philippine Journal of Science, vol. xiii., p. 140) I recorded a second *Androgynella*, from the Philippine Islands, as *A. subrixator*. This was evidently derived from *Megachile subrixator* Ckll., but the female had no ventral scopa, and the anterior coxae were spined. In one specimen the antennae were 13-jointed, in another 12-jointed. This could be regarded as a gynandromorph of *M. subrixator*.

Still more recently (Trans. Amer. Entom. Soc., vol. liv., 1929) T. B. Mitchell has published an extremely interesting paper on "Sex Anomalies in the genus *Megachile*," in which he records a number of remarkable cases from North and South America. The paper is an elaborate one, and may be commended to those interested in the problem of *Androgynella*.

## THAUMATOSOMA Smith.

In *Androgynella* it is the female which departs from the type of *Megachile*, but in this genus it is the male. The extraordinary antennae render the males easily recognisable, but the females will be taken for small species of *Megachile*. The first female to be described was *T. callurum*, and I said at that time (Ann. Mag. Nat. Hist., December, 1914) "The genus *Thaumatostoma* is founded on a secondary sexual character, and the female cannot be distinguished from the group of Australian *Heriades*-like *Megachile*, which, however, should probably be separated from true *Megachile*." A little later (Ann. Mag. Nat. Hist., March, 1915) Meade-Waldo gave an excellent figure of the female *T. duboulayi*. Two species of the genus have been described from tropical Asia, but whether they are really congeneric, or merely represent a parallel development, remains to be ascertained.

*Thaumatostoma duboulayi* Smith.

West Australia, where both sexes were collected in recent years by Turner, In Trans. Amer. Ent. Soc., xxxi. (1905), p. 331, I gave some notes on the type male. The flagellum is thread-like, with the last joint and the apical half of the one before, together forming a flat black disc. The female is 12 mm. long, with the ventral scopa very pale yellowish.

*Thaumatostoma turneri* Meade-Waldo.

The type locality is Kuranda, but it has also been taken at Mackay, Port Darwin and Baudin Island. The supposed *T. duboulayi* recorded from Port Darwin was *T. turneri*. The male is 7 mm. long, and has the antennae gradually narrowing toward the apex. The first abdominal sternite is simple, instead of being tuberculate as in *T. burmanicum* Bingham, from Burma.

*Thaumatostoma callurum* Cockerell.

This was found by Froggatt at Yarrawin, W.A. It is known by its small size (♂ about 5.5 mm.; ♀ about 7 mm.) and partly red abdomen. The ventral scopa is white. The female is very like *Megachile fultoni* Ckll., but has tergites five and six red (*M. fultoni* has only one red segment), and the clypeus and supraclypeal area are quite different.

*Thaumatostoma franki* Friese.

Based on the female only, from Fremantle, W.A. (Deutsch Ent. Zeitschr., 1920, p. 53). It is 12 mm. long, with whitish scopa as in *T. duboulayi*, but has two processes 1.5 mm. long on the clypeus. The antennae are yellowish brown beneath. Tegulae yellowish brown; wings clear. The clypeus must resemble that of *Megachile clypeata* Smith, and there seems to be no assurance that the insect belongs to *Thaumatostoma*.

## MEGACHILE Latreille.

The described Australian species of *Megachile* number 125, but it is not improbable that 300 actually exist. The genus is spread over the greater part of the world, with an enormous number of species. Typical *Megachile* has the habit of cutting semicircular pieces out of leaves (often rose leaves), to cover or line its cells. This is an ancient habit, leaves cut in this manner having been found fossil in the miocene shales of Florissant, Colorado. In the same shales a *Megachile* (*M. praedicta* Ckll.) has been found fossil.\* The species of *Megachile* have accordingly been called Leaf-cutting Bees, and occasionally they are so numerous as to be seriously destructive in orchards and gardens. In recent years, however, it has been discovered that this habit is not uniform. We owe to Mr. H. Hacker the discovery

\*See Nature, February 10, 1910, p. 429; Canad. Entom., January, 1908, p. 31; Ann. Ent. Soc. Amer., 1909, p. 253.

that an Australian group (subgenus *Hackeriapis* Cockerell, 1922) makes resin nests, as is the case with one group of the subfamily Anthidiinae. This group of resin workers includes such species as *M. rhodura* Ckll., *M. hackeri* Ckll., *M. mystacea* Fab., and *M. ustulata* Smith. Mr. Timberlake states that *M. schauinslandi* Alfken, in the Hawaiian Islands, has the same habit, sometimes nesting in keyholes. Still more recently (1927) Mr. Chas. H. Hicks has announced that the North American subgenus *Oligotropus* Robertson, 1903 (also found in Japan) consists of resin workers.

This diversity of habits, in a genus so varied and rich in species, suggests the desirability of subdivision. It would at any rate be convenient to recognise a number of subgenera, and not unreasonable to place the resin workers in a distinct genus. In the latter case, it would be a question whether to call this genus *Oligotropus*, with *Hackeriapis* as a subgenus, or to recognise two resin-working genera. What we need is an exhaustive study of the mouth parts, genitalia, and other characters of the whole genus *Megachile*, and this undertaking may be commended to some ambitious young worker. But in the meanwhile, the species must be described, and the collections in museums built up to afford materials for a future grand revision.\*\*

Friese has proposed a subgenus *Eumegachile* for some large Asiatic species with very short clypeus. He also calls this the "group bombycina," hence *M. bombycina* Rad., may be considered the type. Meade-Waldo (1912) has referred certain Australian species (*M. monstrosa*, *M. semiluctuosa*, *M. aurifrons*, *M. nasuta*) to *Eumegachile*, but they are diverse among themselves, and perhaps not closely related to the Asiatic bees. They agree (females) in having the clypeus very short, three or four times as broad as long, more or less armed with tubercles or lobes at apex; ventral scopa pale, and the insects black with pale pubescence.

The following table is not complete, as it has not been possible to assemble all the species at any one time, but it will facilitate determination. I have included some species of the Pacific Islands, and certain related genera likely to be confused with *Megachile*.

- (A.) Abdomen largely or wholly red, the colour tegumentary.
- |   |    |
|---|----|
| First abdominal tergite black . . . . . | 1. |
| First abdominal tergite red . . . . .   | 2. |
1. Second tergite wholly black; red of abdomen darker than *M. semicandens*; mesothorax with distinctly separated punctures on a shining ground . . . . . *stalker* Ckll.  
(See also *M. calida* Sm., tergites 1—2 black, 3—6 red.)  
Much larger than *M. stalker* (length about 10.5 mm.); a little red on hind margin of second tergite; mesothorax closely punctured. . . . . *pararhodura* Ckll.  
Second tergite partly red; mesothorax extremely densely punctured . . . . . *semicandens* Ckll. ♂
2. Larger and more robust; cheeks broad, shining . . . . . *abdominalis* Sm.  
Smaller and narrower; cheeks narrower, rough (Pt. Darwin) . . . . . *micrerythrura* Ckll., ♂, ♀.  
(See also *M. barvonensis* Ckll.)
- (B.) Abdomen with red tomentum; wings dark. The tegument is not red.  
Vertex very shiny, with sparse large punctures; second and third tergites with dark red hair except apically; ventral scopa fulvous red. . . . . *ustulata* Smith.  
Vertex rough or densely punctured . . . . . 1.

\*\*At present, the Queensland Museum has the largest collection in Australia, with 49 out of the 125 known.



1. Larger and more robust; anterior tarsi of male pallid and flattened.  
     . . . . . *ustulatifomis* Ckll.  
     Smaller and less robust; anterior tarsi less modified; female with  
     second and third tergites having clear orange hair all over. . . .  
     . . . . . *mystacea* Fabr.
- (C.) Abdomen not red, either from the tegument or pubescence, except in  
     many species a red patch or area at the apex, or on the apical  
     portion.  
     Wings sharply bicolored, dark brown with hyaline base; hair of thorax  
     and base of abdomen orange ferruginous, sometimes white in  
     males (Hawaiian Is.) . . . . . *schauinslandi* Alfken.  
     (Australian species with bicolored wings are *M. fabricator* Sm., *M.*  
     *semiclara* Ckll. and *M. batchelor* Ckll., concerning which see  
     Mem. Queensland Mus., ix. (1929), pp. 303, 304.)  
     Wings not thus bicolored . . . . . 1.
1. Flagellum very slender, long, clay colour, with an expanded flattened  
     black apex; abdomen beyond the third tergite red. . . . .  
     . . . . . *Thaumatosa callurum* Ckll., ♂.  
     Flagellum not thus . . . . . 2.
2. Abdomen with metallic colours . . . . . 3.  
     Abdomen not metallic . . . . . 4.
3. Ventral scopa red . . . . . *pictiventris* Sm.  
     (*M. haematogastra* Ckll. has a red scopa, but abdomen is not metallic.)  
     Broad female with red scopa (Mackay, Queensland) . . *rowlandi* Ckll.  
     Smaller than *M. pictiventris*, and with narrow white abdominal  
     bands . . . . . *ignescens* Ckll.  
     Scopa black . . . . . *viridinitens* Ckll.
4. Black, with black hair and scopa, a little pale in front of anterior  
     orbits; large species with very dark wings . . . . .  
     . . . . . *doddiana* var. *clarkei* Ckll.  
     Not thus black haired . . . . . 5.
5. Large parallel-sided species, 15 mm. long or over, with dark fuscous  
     wings; white hair at base of abdomen, no red hair at apex, scopa  
     pale; female with large dentiform structures on under side of  
     head . . . . . 6.  
     Otherwise . . . . . 7.
6. Anterior tarsi of male broad and cream-colour . . *cornifera* Rads.  
     (See also *monstrosa* Sm.)  
     Anterior tarsi of male simple . . . . . *oppidalis* Ckll.
7. Ventral scopa of female absent . . . . . *Androgynella detera* Ckll.  
     (This is very like *M. quinquelineata* except as to scopa, but last  
     tergite is covered with pale hair, which is not the case in  
     *quinquelineata*.)  
     Ventral scopa of female present . . . . . 8.
8. Ventral scopa red, at least in large part . . . . . 9.  
     Ventral scopa not red; or males . . . . . 13.
9. Wings very dark, with violaceous tints; sides of first two abdominal  
     tergites with dense pure white tomentum (Cape York) . . . . .  
     . . . . . *cincturata* Ckll.  
     Wings hyaline or subhyaline . . . . . 10.
10. Scopa black on last two segments (New Caledonia) . . . . .  
     . . . . . *albomarginata* Sm.  
     Scopa red on penultimate segment . . . . . 11.
11. Thorax with much black hair above; larger and more robust (New  
     Hebrides) . . . . . *calens* Ckll.  
     (*M. woodfordi* Ckll., from the Solomon Is., also falls here, but the  
     sixth tergite of male is quite different from that of *calens*.)



- Thorax without black hair above; smaller species . . . . . 12.
12. Abdominal hair bands pure white (Guam) . . . . . *fullawayi* Ckll.  
 Abdominal hair bands red (Hawaiian Is.) . . . . . *diligens* Sm.
13. More or less elongated, parallel-sided species, with white hair at base of abdomen, and no red hair apically, nor tegument red 14.  
 Otherwise . . . . . 20.
14. Males . . . . . 15.  
 Females . . . . . 16.
15. Hair of face pale orange; antennae simple at end . . . . . *latipes* Sm.  
 Hair of face pure white; antennae expanded at end . . . . . *semiluctuosa* Sm.
16. Ventral scopa black . . . . . *fumipennis* Sm.  
 (The male of *M. doddiana* looks like this, but differs greatly in sculpture.)  
 (*M. viridinitens* Ckll. has the aspect of *fumipennis*, but abdomen metallic.)  
 Ventral scopa white . . . . . 17.
17. Front with dense bright orange tomentum; clypeus much modified; scape red . . . . . *aurifrons* Sm.  
 Without such orange tomentum . . . . . 18.
18. (In this group falls *blackburnii* Froggatt, with legs partly red.)  
 Clypeus with a broad arch-like structure, below which is a shining space . . . . . *semiluctuosa* Sm.  
 Clypeus simple, dull and rugose, with straight margin . . . . . *suffusipennis* Ckll.  
 Clypeus with denticulate lower margin . . . . . *lucidiventris* Sm.  
 Clypeus with a median apical point or tubercle . . . . . 19.
19. Abdomen with large conspicuous punctures . . . . . *revicta* Ckll.  
 Abdomen with fine punctures . . . . . *remeata* Ckll.  
 (The following will also be useful:—  
     Mandibles very long . . . . . 1.  
     Mandibles short and broad . . . . . 2.  
     1. Mandibles bidentate . . . . . *remeata* Ckll.  
     Mandibles tridentate . . . . . *semiluctuosa* Sm.  
     2. First abdominal tergite with white hair right across . . . . . *revicta* Ckll.  
     First tergite with lateral patches of white hair . . . . . *suffusipennis* Ckll.)
20. Males . . . . . 21.  
 Females . . . . . 59.
21. Anterior tarsi simple . . . . . 22.  
 Anterior tarsi modified . . . . . 44.
22. Very small species, with aspect of *Heriades*; tegument of end of abdomen red . . . . . 23.  
 Much larger, or if small, tegument of end of abdomen not red . . . . . 25.
23. Mandibles broad, mainly yellow; flagellum pale reddish beneath except at end . . . . . *apicata* Smith.  
 (Compare also *gilbertiella* Ckll.)  
 Mandibles black . . . . . 24.
24. Flagellum black . . . . . *hackeri* Ckll.  
 Flagellum pale red beneath except at end . . . . . *fulltoni* Ckll.
25. Anterior tarsi red . . . . . 26.  
 Anterior tarsi black . . . . . 28.
26. Abdomen with deep red hair-bands; fifth and sixth tergites not covered, with tomentum (Solomon Is.) . . . . . *woodfordi* Ckll.  
 Abdomen without such bands; fifth and sixth tergites with ochreous tomentum . . . . . 27.

27. Anterior femora apically, and tibiae on inner side red; sixth abdominal segment bidentate . . . . . *sequior* Ckll.  
Anterior femora and tibiae black, tibiae with a little red at extreme apex; sixth segment emarginate . . . . . *derelicta* Ckll.
28. Face covered with golden or yellow hair . . . . . 29.  
Face with white or cream-coloured hair . . . . . 32.
29. Abdomen with distinct hair-bands . . . . . 30.  
Abdomen without hair-bands . . . . . 31.
30. Middle tarsi with a very long fringe of pure white hair; abdominal bands entire . . . . . *Androgynella detera* Ckll.  
(See also *Megachile ciliatipes* Ckll.)  
Middle tarsi with a very long fringe of grey hair; abdominal bands broad and orange at sides, evanescent in middle . . . . .  
 . . . . . *rhodogastra* Ckll.  
Middle tarsi with only a short fringe; abdominal bands orange, entire . . . . . *kurandensis* Ckll.  
(*M. palmarum* Perkins, from Hawaiian Is., with yellowish hair on face, has middle tarsi with rather short white fringe; abdominal bands white, entire.)
- (The anterior tarsi are slightly modified in some of these, including the following:—  
Hair of thorax above all light yellow . . . . . *serricauda* Ckll.  
Hair of thorax above with much black . . . . .  
 . . . . . *ciliatipes* Ckll. and *A. detera* Ckll.)
31. End of abdomen with no patch of red hair . . . . . *sericeicauda* Ckll.  
End of abdomen with a patch of red hair . . . . . *erythropyga* Smith.  
(*rufolobata* Ckll., with slightly modified anterior tarsi, could go here, but is much larger.)
32. Sixth tergite red . . . . . 33.  
Sixth tergite not red . . . . . 35.
33. Sixth tergite bidentate . . . . . *rhodogastra* Ckll.  
Sixth tergite shallowly subemarginate . . . . . 34.
34. Mesothorax shining between the punctures; face narrow . . . . .  
 . . . . . *rhodura* Ckll.  
Mesothorax dull, face broad . . . . . *ramulipes* Ckll.

(The following supplementary table will be useful:—

- |   |    |
|---|----|
| Hair of face golden or deep fulvous . . . . . | 1. |
| Hair of face white or cream-colour . . . . .  | 3. |
1. Small species like *sequior* group, with ochreous or red hair bands, and edge of sixth tergite jagged; anterior tarsi with a groove . . . . . *serricauda* Ckll.  
Species of *ferox* type, with parallel-sided abdomen and large red caudal patch; sixth tergite not jagged. . . . .  
 . . . . . 2.
  2. Second and third abdominal segments with apical reddish bands at sides . . . . . *mackayensis* Ckll.  
Second and third segments without such bands . . . . .  
 . . . . . *erythropyga* Sm.
  3. Apex of abdomen with the tegument red. . . . . 4.  
Apex of abdomen with the tegument not red. . . . . 5.
  4. Larger; abdomen with small punctures . . . . . *rhodogastra* Ckll.  
Smaller; abdomen with large punctures . . . . . *rhodura* Ckll.
  5. End of abdomen with two sharp teeth . . . . . *trichognatha* Ckll.  
End of abdomen with two blunt lobes . . . . . *tomentella* Ckll.  
End of abdomen entire . . . . . *holura* Ckll.)

35. Fifth tergite covered with bright red or orange tomentum . . . . . 36.  
 Fifth tergite not so covered . . . . . 39.
36. Apex of abdomen (sixth tergite, not the morphological apex)  
 bidentate . . . . . 37.  
 Apex of abdomen bilobate . . . . . 38.
37. Scutellum with long black hair (New Hebrides) . . . . . *calens* Ckll.  
 Scutellum with white hair (Tahiti) . . . . . *doanei* Ckll.
38. Here falls *horatii* Ckll. and *heriadiformis* Sm., as determined by Meade-Waldo.
39. Margin of sixth tergite sharply denticulate (Hawaiian Is.) . . . . .  
 . . . . . *timberlakei* Ckll.  
 Margin of sixth tergite not denticulate . . . . . 40.
40. Abdomen with a large patch of dense pure white hair at sides of base; wings very dark . . . . . *cincturata* Ckll.  
 Abdomen without such patches . . . . . 41.
41. Disc of fifth tergite covered with appressed ochreous-tinted hair; small *Heriades*-like species; hair of face pure white. *victoriae* Ckll.  
 Fifth tergite with conspicuous pale hair only at base, if at all . . . . . 42.  
 . . . . . 43.
42. Thorax above with pale hair . . . . . 43.  
 Thorax above with much black hair . . . . . *austeni* Ckll.
43. Small species; sixth tergite obtusely bilobed . . . . . *victoriae* Ckll.  
 (fifth tergite abraded).  
 Medium sized species; sixth tergite with a semicircular incision (Hawaiian Is.) . . . . . *palmarum* Perkins.  
 (Compare here *M. tenuicincta* Ckll. with long black hair on thorax above.)  
 (To be compared with this series is also *M. leucopogon* Ckll., very like *timberlakei*, but sixth tergite bilobed, not denticulate; tarsi thicker.)
44. With a conspicuous red caudal or subcaudal patch. . . . . 45.  
 Caudal patch, if any, ochreous or pale . . . . . 50.
45. Abdomen with entire red hair-bands; face with orange hair; anterior tarsi little modified . . . . . *serricauda* Ckll.  
 Abdomen without red hair-bands . . . . . 46.
46. Sixth tergite bidentate, and dorsally covered with tomentum . . . . . 47.  
 . . . . . 48.  
 Sixth tergite otherwise . . . . . 49.
47. Anterior tarsi with a large red rounded lobe . . . . . *chrysopyga* Smith.  
 Anterior tarsi without such a lobe . . . . . *phenacopyga* Ckll.
48. Sixth tergite broadly truncate, the truncation with sharply angular corners; below this a pair of broad divergent rounded processes; anterior tarsi not much modified . . . . . *resinifera* M.-Waldo.  
 Sixth tergite with two broad obtuse lobes; fifth and sixth tergites with tegument red; anterior tarsi little modified. *rufolobata* Ckll.  
 Sixth tergite briefly and very obtusely bilobed; smaller species . . . . . 49.
49. Flagellum expanded at end . . . . . *ferox* Sm.  
 Flagellum not expanded at end . . . . . *latericauda* Ckll.
50. Sixth tergite with a median spine; hair of face white . . . . . *vestitor* Ckll.  
 Sixth tergite without a median spine . . . . . 51.
51. Keel of sixth tergite broadly rounded or subtruncate, neither dentate nor emarginate; scape clear red . . . . . *oculipes* Ckll.  
 Keel of sixth tergite not so, or if feebly emarginate, scape black . . . . . 52.

52. Keel of sixth tergite denticulate, with a series of little dentiform spines . . . . . *serricauda* Ckll.  
 Keel of sixth tergite not denticulate . . . . . 53.
53. Keel of sixth tergite broadly truncate, with an emargination, or with a pair of broad truncate lobes . . . . . *recisa* Ckll.  
 Keel of sixth tergite otherwise . . . . . 54.
54. Anterior legs all black; tarsi very little modified; hair of face golden . . . . . *ciliatipes* Ckll.  
 Anterior legs not all black; tarsi more modified . . . . . 55.
55. Scutellum with white hair; small species; sixth tergite with a pair of short spines . . . . . 56.  
 Scutellum with much black hair; larger species; sixth tergite strongly bispinose . . . . . 57.
56. Anterior femora clear red; anterior tarsi cream colour, with a long fringe of white hair . . . . . *captionis* Ckll.  
 Anterior femora black; anterior tarsi red; small *Heriades*-like species . . . . . *tasmanica* Ckll.
57. Anterior tibiae black; tarsi not very greatly modified (New Caledonia) . . . . . *australis* Lucas.  
 Anterior tibiae largely red . . . . . 58.
58. Sixth tergite black; abdomen between the bands with much erect black hair (New Caledonia) . . . . . *albomarginata* Smith.  
 Sixth tergite densely covered with pale yellow or cream-coloured tomentum . . . . . *lineatipes* Ckll.  
 (*M. lineatipes* differs from *chrysopyga* by the paler and very much reduced lobes of anterior tarsi. The sixth tergite has two sharp teeth.)
59. Ventral scopa black; a patch of red hair on last tergite; first two tergites with marginal bands of pure white hair . . . . . *resinifera* Meade-Waldo.  
 Ventral scopa not black, or only so apically . . . . . 60.
60. No patch of red or reddish hair on apical or subapical part of abdomen . . . . . 61.  
 With a patch of red or reddish hair or colour on apical or subapical part of abdomen . . . . . 70.
61. Flagellum clear red beneath; mandibles red; last tergite thinly hairy, but seen from above, the surface is not hidden or covered by light tomentum . . . . . *adelaidae* Ckll.  
 (*M. relicta* is closely allied, but has dorsal surface of apical half of abdomen conspicuously white-hoary.)  
 Flagellum dark, or if clear red beneath, last tergite with much pale hair . . . . . 62.
62. Last tergite with much pale hair . . . . . 63.  
 Last tergite appearing black, without pale hair . . . . . 66.
63. Ventral scopa entirely white to end; small species. . . . . 64.  
 Ventral scopa black at tip; broad, larger species . . . . . 65.
64. Abdomen with four very distinct narrow white bands . *simplex* Smith.  
 Abdomen hoary, without distinct bands . . . . . *relicta* Ckll.
65. Last tergite with a broad transverse band of dense pure white tomentum . . . . . *captionis* Ckll.  
 Last tergite with pale grey tomentum, the apex black . . . . .  
 . . . . . *macularis* Dalla Torre.  
 (In *M. sequior* the apex is not black.)  
 (Friese had identified *M. macularis* as *M. australasiae* D.T., but the species, as I noted in British Museum, has the abdomen with broad fulvous hair-bands. The scopa is white, black on last segment.)



66. Thorax above appearing black, with four very conspicuous white spots (New Caledonia) . . . . . *australis* Lucas.  
 Thorax not thus conspicuously white-spotted . . . . . 67.
67. Tegulae testaceous (Hawaiian Is.) . . . . . *timberlakei* Ckll.  
 Tegulae black, or partly dark red . . . . . 68.
68. Clypeus with a median smooth line; hind basitarsi with white hair posteriorly . . . . . *cetera* Ckll.  
 Clypeus with no median smooth line . . . . . 69.
69. Hind basitarsi with long black hair posteriorly . . . *quinquelineata* Ckll.  
 Hind basitarsi with short pale hair posteriorly (Hawaiian Is.) . . . *palmarum* Perkins.  
 (*M. tenuicincta* Ckll. runs to *palmarum*, but has long black hair on head and thorax above.)
70. (The apical patch is ochreous in *sequior*; whitish or ochreous in *simplex*.)  
 Abdomen with entire ochreous hair-bands on tergites 1 to 5; apical tergite covered with pale ochreous (not red) tomentum . . . . . *sequior* Ckll.  
 Abdomen without such hair-bands . . . . . 71.
71. Red confined to apical segment . . . . . 72.  
 Red not confined to apical segment (if a little on penultimate segment, a broad species, see *chrysopyga*) . . . . . 73.
72. Hair of face white . . . . . 73.  
 Hair of face orange-ferruginous; rather large, robust species . . . . . 77.
73. Small *Heriades*-like species, not over 8 mm. long . . . . . 74.  
 Medium sized, ordinary species . . . . . 76.
74. Flagellum entirely dark . . . . . *hackeri* Ckll.  
 Flagellum clear red beneath . . . . . 75.
75. A broad shining band across upper edge of clypeus and lower edge of supraclypeal area; tegulae dark . . . . . *apicata* Smith.  
 (In *M. gilbertiella* the red of fifth tergite may be confined to apical margin, and then it approaches *apicata*.)  
 No such shining band; tegulae red . . . . . *fultoni* Ckll.
76. Clypeus produced, snout-like . . . . . *nasuta* *argentifer* Ckll.  
 Clypeus ordinary . . . . . *subferox* Meade-Waldo.
77. Abdomen parallel-sided, without distinct bands . . . . . *henrici* Ckll.  
 Abdomen broad, distinctly banded; a little red on apex of penultimate segment . . . . . *chrysopyga* Smith.
78. Fourth tergite with much red hair . . . . . 79.  
 Fourth tergite without red hair . . . . . 80.
79. Red hair only on apical half of fourth tergite; front with orange ferruginous hair . . . . . *mackayensis* Ckll.  
 Fourth tergite covered with pale red hair; hair of face and front white . . . . . *rhodura* Ckll.
80. Face and front with orange hair . . . . . *ignita* Smith.  
 (*M. ignita* has conspicuous white lateral hair-patches on tergites 1 to 3. It resembles *M. trichognatha*, but is more robust, and tegument at apex of abdomen is red. It has been confused with *M. erythropyga* Sm.)  
 Face and front with hair not orange . . . . . 81.
81. Clypeus apically with a median lamina, on each side of which is a smooth shining hollow . . . . . *derelicta* Ckll.  
 Clypeus apically with a median tubercle, but no shining hollows; smaller species . . . . . *trichognatha* Ckll.  
 Clypeus with no median tubercle or lamina (has a very small one in *trichognatha* var. *tosticauda* Ckll.) . . . . . 82.

82. Tegument of apex of abdomen red; small *Heriades*-like species . . . . . 83.  
 Tegument of apex of abdomen not, or not distinctly, red . . . . . 84.  
 83. End of abdomen dark red; narrow species . . . . .  
     . . . . . *Thaumatostoma callurum* Ckll.  
 End of abdomen clear red; robust species; two little teeth on margin  
     of clypeus . . . . . *gilbertiella* Ckll.  
 84. Fifth tergite black at base and basal corners, the red sharply  
     limited . . . . . *ferox* Sm.  
 Red on fifth tergite not thus limited . . . . . 85.  
 85. Apical tergite with thin pale grey or silvery hair . . . . . *simplex* Smith.  
 Apical tergite with golden hair . . . . . 86.  
 86. Clypeus very finely granular . . . . . *simpliciformis* Ckll.  
 Clypeus distinctly punctured . . . . . *heliophila* Ckll.

(The following supplementary table of females will be useful:—

- Clypeus with a big outwardly projecting tooth on each  
 side . . . . . *preissi* Ckll.  
 Clypeus without such teeth . . . . . 1.  
 1. Clypeus with a median process on lower margin . . . . .  
     . . . . . *trichognatha* Ckll.  
 Clypeus without such a process . . . . . 2.  
 2. Mesothorax very finely punctured; red hair quite or nearly  
     confined to last segment . . . . . *remotula* Ckll.  
 Mesothorax with larger punctures, clearly visible under a  
     lens . . . . . 3.  
 3. Tegument of apex of abdomen not red . . . . . *eucalypti* Ckll.  
 Tegument of apex of abdomen red . . . . . 4.  
 4. Length about 13 mm. . . . . *rhodura* Ckll.  
 Length about 8.5 mm. . . . . *gilbertiella* (Ckll.)

*Megachile abdominalis* Smith.

A small species, less than 9 mm. long, with light red abdomen and hyaline wings. It appears to be rather common in Queensland. The original locality, as given by Smith, is "New Holland." Both sexes are known, though Smith only described the male. According to Meade-Waldo, the male in the British Museum is from the Macintyre River. (Q.).

*Megachile adelaidae* Cockerell.

Discovered by Schomburgk at Adelaide, the type in Berlin Museum. Female 10 mm. long, a small ordinary-looking species, with large and broad head, mandibles deep red, flagellum bright ferruginous beneath, mesothorax and scutellum extremely densely punctured, mesothorax with a pair of small spots of white hair anteriorly; wings hyaline; ventral scopa white, black on last segment. Resembles *M. macularis*, but much smaller, and with differently coloured mandibles.

*Megachile alani* Cockerell.

Female 9.5 to 11.5 mm. long; rather robust, but of parallel sided type; tegument of sixth abdominal segment (above and below) and narrow apical margin of penultimate tergite, clear ferruginous. Very like *M. rhodura*, but easily separated by the structure of the clypeus, which is broad and short, the anterior margin strongly concave, forming a broad arch, in the middle with two very large shining pits, separated by a small ridge, the clypeus otherwise very densely punctured. Found by Alan P. Dodd at Moree, N.S.W., type in Queensland Museum (Mem. Queensl. Mus. June, 1929, p. 302). (Q.).

*Megachile albobasalis* Smith.

A remarkable species, the abdomen with first tergite above covered with white tomentum, second and remaining segments red above and below. Only known from Murray Island, Torres Straits, and in the female sex. Friese, in 1908, gave a coloured figure purporting to represent *M. albobasalis* from Queensland, but it was really *M. pretiosa* Friese, correctly described as distinct in 1909.

*Megachile annae castaneipes* Friese.

*M. annae* Friese was collected at Etna Bay, New Guinea; the female 10 mm. long, resembling *M. cingulata* Friese from the Key Island, but broader, clypeus impressed in middle and emarginate, tergites 2 to 4 with yellowish bands; ventral scopa yellow, black at sides. The var. *castaneipes*, with red scopa, only black at extreme sides, and all the tarsi red-brown, is from Cairns, Queensland. It is probably a distinct species. Friese gives coloured figures of both species and variety; they appear ordinary-looking, grey, the face covered with bright orange hair.

*Megachile apicata* Smith.

Based on a female from Adelaide, but known to occur in Western Australia, and east to Victoria, where it seems to be common. It is only about 8 mm. long, the sixth tergite laterally ferruginous. For other characters see under *M. hackeri*.

*Megachile atrella* Cockerell.

Female about 9 mm. long, abdomen parallel-sided, but short; head large; clypeus with large confluent punctures, the upper part with a central smooth shining area; mandibles dark red, quadridentate; wings hyaline; ventral scopa white with a faint yellowish tint, black on last segment. An ordinary-looking species resembling the European *M. rotundata* in general appearance, but more robust. It is from West Australia; type in British Museum.

*Megachile aurifrons* Smith.

This well known insect was based on the female, from New Holland. It has been found from Perth to New South Wales, and north to Queensland. It is about 13 mm. long, the face covered with dense golden hair. The apex of clypeus presents a broad subquadrate lobe. It is possible that *M. oculipes* is the male of *M. aurifrons*; it has the same distribution. (Q.).

*Megachile austeni* Cockerell.

The type, in the British Museum, was collected near Mackay by Turner, and is a male. Hacker has since described the female. The male is about 10.5 mm. long, face covered with white hair; long black hair on vertex, mesothorax and scutellum, and partly on front; mandibles black, quadridentate; anterior wings with the apical half mostly dilute fuliginous; anterior tarsi simple; abdomen short and parallel-sided, with white marginal hair-bands only at sides of segments; apex of sixth tergite emarginate. Hacker took both sexes of flowers of *Ipomoea* on Stradbroke Island. The female is about 15 mm. long; face with white hairs mixed with black, giving it a greyish appearance; vertex, mesothorax and scutellum with black hair; a small patch of white hair on each side at base of tegulae; hind legs very long and stout; ventral scopa black. (Q.).

*Megachile australasiae* Dalla Torre.

This is *M. imitata* Smith, 1868, the name preoccupied. It is from Champion Bay, W.A., and Smith describes it as closely resembling the European *M. argentata*. The face is clothed with pale yellow hair, but that on cheeks is silvery. It can be distinguished from *M. macularis* by the absence of spots of pubescence on the mesothorax. The male is unknown.

*Megachile axillaris* Meade-Waldo.

Female 15 mm. long; clypeus, inner orbits, thorax (especially pleurae), axillae and metathorax, as well as linear marks on apices of tergites 1—3 laterally, with white hair; ventral scopa silvery white, segment six fuscous; tergites 5 and 6 with bright ferruginous hair. The clypeus is peculiar, very short, broad, and deeply emarginate, the sides produced into subquadrate laminae. Found by R. Turner at Yallingup, W.A. Structurally there is some resemblance to the much smaller *M. preissi*.

*Megachile barvonensis* Cockerell.

Male about 6.5 mm. long, *Heriades*-like, with clear bright red abdomen, the first tergite with the basin (except upper part) and cloud on each extreme side black. Very close to *M. micrerythra*, but tarsi only red apically; no white spots in scutello-mesothoracic suture (but a white hair spot at each corner of mesothorax, the posterior ones conspicuous); sixth abdominal tergite bidentate, the short tubercle-like teeth wide apart. Yarrowin, N.S.W. (Froggatt).

*Megachile batchelori* Cockerell.

Female nearly 15 mm. long, with pure white ventral scopa, black on last two segments. The wings have the apical part abruptly fuliginous, and the abdomen has white hair at base. Allied to *M. fabricator*, but that has the face and front with pale ochreous hair, and the clypeus with black; *M. batchelori* has the hair of head white, but black intermixed on clypeus and front, and vertex all black. Found at Hughenden, Queensland, on the edge of the Richmond Downs, by H. H. Batchelor. (Mem. Queensl. Museum, June, 1929, p. 304). (Q.).

*Megachile beutenmulleri* Cockerell.

Male 10.5 mm. long, the parallel-sided abdomen with a large patch of bright orange-red tomentum occupying the fifth tergite except at sides, and the adjacent apical margin of the fourth. Face densely covered with pale yellow hair; clypeus normal; thorax with long white hair, with black interspersed on mesothorax, and a little on scutellum; viewed from the side, the front of the mesothorax appears white-haired, and the region immediately behind this black-haired; anterior tarsi slender and simple; tegulae black; sixth tergite broadly emarginate, the sides of the emargination very obtuse. Victoria. Type in American Museum of Natural History, New York. Somewhat related to *M. erythropyga* Sm. and *M. canifrons* Sm.

*Megachile blackburnii* Froggatt.

Female 8 lines long; face densely clothed with silvery white hair; thorax white-haired; fore legs ferruginous on upper side of tibiae, "tarsi produced into bright yellow pollen brush"; middle legs ferruginous on upper side of tibiae and tarsi; abdomen constricted at base of each segment; first segment densely clothed with long white hair, second with a bright white patch of short silvery hairs on each side; under side of abdomen clothed with long white hairs, forming a tuft standing out on either side of last segment; wings hyaline. Male, 5 lines; all the legs black and closely covered with white hairs; first and second segments of abdomen above clothed with long white hairs. This information is abstracted from Froggatt's description; there is a figure in Froggatt's Australian Insects, plate xvi. Central Australia (R. Helms). The male from Mount Squires.

*Megachile calida* Smith.

Smith described both sexes from Queensland. Meade-Waldo notes that the female is 10 mm. long; abdominal tergites 1 and 2 black, 3 to 6 ferruginous. The abdomen above is hairy, not nude as in *M. abdominalis*.



The male is said by Smith to be rather smaller, the face with white hair; the two first tergites black, the first with a ferruginous band, the second with the apical half red like the rest of the abdomen. The margin of sixth tergite entire, with a slight central depression.

*Megachile canifrons* Smith.

Meade-Waldo notes from Smith's type: male, length 9 mm.; abdomen black, with white pubescence basally; fifth tergite with a patch of ferruginous hair; sixth tergite bluntly rounded. The type is from Western Australia. Hacker has found it at Brisbane. (Q.).

*Megachile captionis* Cockerell.

Male very close to *M. macularis* and *M. cygnorum*, but small, length about 9 mm.; anterior tibiae bright ferruginous, with a large basal black spot anteriorly; second joint of anterior tarsi with a more or less evident black spot visible from without (as in *M. darwiniana*); fifth tergite with erect white or yellowish-white hair. Vertex with hair entirely pale, not mainly black as in *M. darwiniana*.

Female about 10 mm.; aspect of *M. quinquelineata*, the ventral scopa (white, black on last segment and extreme sides of penultimate) and light abdominal bands practically the same, but mesothorax much more finely punctured and sixth tergite with a broad band of dense white tomentum. New South Wales and Victoria, the type taken by Froggatt. (Q.).

*Megachile carteri* Cockerell.

Female about 9 mm. long, rather narrow, black, of ordinary aspect; clypeus coarsely rugosopunctate; sides of face with white hair; abdomen with linear white hair-bands; ventral scopa white. Kuranda, Queensland (H. J. Carter). It is related to *M. quinquelineata*, but the clypeus lacks the tufts of hair at sides, and there is no band of light hair in the scutello-mesothoracic suture. The type is in the Australian Museum.

*Megachile cetera* Cockerell.

Another species resembling *M. quinquelineata*; the differences are partly set forth in the key. The Hawaiian *M. timberlakei* is so close to *M. cetera* that I am not sure that they are different species. I do not know the male of *M. cetera*, and have seen no Australian male agreeing with the male of *M. timberlakei*.

The type locality is Nagambie, Victoria (French); it also occurs in New South Wales, and north as far as Brisbane. (Q.).

*Megachile chrysopyga* Smith.

A well known species, recognisable from the characters given in the key. The female is about 12.5 mm. long, the face densely covered with fulvous hair. Smith describes both sexes, and gives the localities as Van Dieman's Land and Western Australia. It appears to be common in Victoria, and thence north to Brisbane. *M. maculariformis* Ckll., from New South Wales, is a synonym. (Q.).

*Megachile chrysopygopsis* Cockerell.

The female, about 12.5 mm. long, looks like *M. chrysopyga*, but the hair of face is dull white. The vertex has dark fuscous hair. Thorax above with white hair-spots. Ventral scopa white, black on last segment and sides of penultimate. Perth, W.A. (G. H. Hardy). (Mem. Queensl. Mus., June, 1929, p. 302). (Q.).

*Megachile ciliatipes* Cockerell.

Known from the male, collected by Hacker at Brisbane, and also found at Kuranda. It is very near to *M. kurandensis*, but has no evident spot of

pale hair in front of axillae, no red or fulvous hair on disc of fifth tergite, anterior tarsi incrassate, etc. It appears practically identical with the male of *Androgynella detersa*, but it may be the male of *M. quinquelineata*. (Q.).

*Megachile cincturata* Cockerell.

This distinct species can readily be identified from the key. Both sexes were taken by Froggatt at Cape York.

*Megachile clypeata* Smith.

Based on a female from Western Australia, in the collection of W. W. Saunders, and now in the Hope Museum at Oxford. It is small, and recognisable by the broad flattened process on each side of the clypeal margin. The apical tergite is ferruginous, and the ventral scopa is white. A near relative is *M. preissi*.

*Megachile conaminis* Cockerell.

A species of *Eumegachile*, the female 18 mm. long, stout, parallel-sided, with mainly black hair, but sides of face and front with pale hair; ventral scopa bright ferruginous, partly black on last segment. Wings dark fuliginous. Clypeus widely excavated in middle, the moderately curved margin thickened and without denticles. Endeavour River, Queensland; type in the Melbourne Museum (National Museum of Victoria).

*Megachile cornifera* Radoszkowsky.

Based on a female, 23 mm. long, said to come from Sydney, but probably not found there. It is known from Western Australia, and appears to be a large variety or race of *M. monstrosa* Smith. The wings are strongly infuscated. The name is derived from the character of the clypeus, emarginate, and with a process at each side. The male is described in Entomologist, May, 1913, p. 164. It is about 19 mm. long.

*Megachile cygnorum* Cockerell.

The male, from Swan River, is about 10 mm. long, allied to *M. darwiniana*, but readily separable from this and *M. gahani* as follows:—

- Upper surface of anterior tarsi with a conspicuous black spot on second joint; anterior femora red . . . . . *darwiniana* Ckll.  
 Upper surface of anterior tarsi without black markings; anterior femora and tibiae mainly red . . . . . 1.  
 1. Fifth tergite with conspicuous erect black bristles; outer edge of anterior tibiae (except at ends) straight . . . . . *cygnorum* Ckll.  
 Fifth tergite without black bristles; outer edge of anterior tibiae presenting an angle a little before the middle . . . . . *gahani* Ckll.

*M. cygnorum* is now known to be widespread, occurring at Adelaide, in Victoria, and north to Mackay, Queensland.

*Megachile darwiniana* Cockerell.

Male, about 10 mm. long, from Port Darwin (J. J. Walker). Type in British Museum. The thorax has a semicircle of white spots, one above each tegula and two (elongated) in scutello-mesothoracic suture. The sixth tergite is invisible from above, and ends in two widely separated teeth. Wings moderately dusky.

*Megachile derelicta* Cockerell.

Female about 12 mm. long, something like *M. heriadiformis*, but with no band on fourth tergite, though second and third tergites have dense bands of pale yellowish hair, failing in middle, becoming white at sides. Fifth and sixth tergites, except at sides, covered with yellow tomentum; ventral scopa white, on last segment fuscous-tinged. Male about 9 mm.; allied to *M. tomentella*, but differing by the dusky wings and conspicuous hair-bands. Described from Windsor, Victoria, but known to go south into Tasmania, and north to Brisbane. (Q.).

*Megachile dinognatha* Cockerell.

Female 18.5 mm. long; very robust, with very large, broad and rounded head; hair of head and thorax very scanty, black on clypeus, white at sides of face, brownish-white on front, dense and pure white at sides of meta-thorax; mandibles extremely massive, with two large teeth and a long cutting edge; clypeus very short and broad (as in *Eumegachile*); ventral scopa pale yellow, becoming dark fuscous at apex. The wings are dark fuscous. Hughenden, Queensland (Batchelor), and Roper River, N.T. In the absence of hair-bands on abdomen it falls with *M. macleayi*, but it is larger, with no red hair on fourth tergite. (Q.).

*Megachile doddiana* Cockerell.

The type was from Townsville, Queensland (F. P. Dodd); the variety *clarkei* Ckll., from Geraldton, W.A., has the hair at sides of first tergite of female entirely black, whereas it is white in the typical form. But more recently the var. *clarkei* has been received from Townsville, and evidently represents no more than a colour variety, apparently the commoner form of the species. The female is about 16.5 mm. long, with very dark fuliginous wings; ventral scopa black. The male, about 12.6 mm. long, the face and front with white hair, is described in Ann. Mag. Nat. Hist., March, 1929, p. 360.

*Megachile erythropyga* Smith.

This can be identified from the key. It is a well known species, found from Perth to Melbourne. Smith describes both sexes. Meade-Waldo notes that the male is 11 mm. long; tergite 6 faintly notched (deeply notched in *M. ignita*); an apical band on fourth tergite and most of fifth ferruginous.

*Megachile eucalypti* Cockerell.

Female about 10 mm. long, parallel-sided, the last three tergites clothed with scale-like fulvous hair, which is so distributed that the surface appears minutely black speckled, the tegument showing through; ventral scopa entirely white. Known from such species as *M. rhodura* and *M. gilbertiella* by having the red or orange colour of apex of abdomen wholly due to hair. The male, related to *M. nigrovittata* and *M. modesta*, is easily known by the extraordinary anterior legs, which are exceedingly modified. The anterior tarsi are broadly expanded, the main part of the joints black, with a short silvery hair-fringe in front, but the expanded lamina white, with a broad black stripe along the posterior margin. The expanded white part of the third joint looks greyish exteriorly, having on the inner side a very large long-oval black spot; the claws are almost sessile on this great expanded structure. Mackay, Queensland, at flowers of *Eucalyptus*, taken by Turner. Type in British Museum.

*Megachile fabricator* Smith.

Known by the bicolored wings, the basal half hyaline, the apical part fuscous; face and front with pale ochraceous hair, clypeus with black; ventral scopa clear white, black on last segment. The male has the basal joint of front tarsi expanded broadly to form a thin semitransparent plate, and all the joints fringed behind with long pale hair, fuscous toward base of first joint. The sixth tergite of male is rounded at margin, with a small acute tooth in middle. Champion Bay, W. Australia. The nearest relative is *M. batchelor* from Queensland.

*Megachile feror* Smith.

The female has the lower edge of clypeus straight and without tubercles (which separates it from the very similar *M. derelicta*); legs black, with red claws and creamy-white spurs; dorsal orange-ferruginous hair-patch covering fifth and sixth tergites, except at sides, and extreme base of fifth;



ventral scopa white, fuscous at extreme apex. In the related *M. heliophila* the mandibles are coarsely strigate and sparsely punctured, while those of *ferox* show three shining longitudinal ridges, with channels between. The male is 11 mm. long, the face covered with white hair; anterior tarsi dilated, and coxae spined. (The male tarsi are simple, and coxae unarmed, in *M. ignita* and *M. erythropyga*). Western Australia to Victoria, and north to Brisbane. The type locality is Swan River (Q.).

*Megachile fultoni* Cockerell.

Female about 7 mm. long, narrow, *Heriades*-like, the apical segment of the abdomen (above and below) bright ferruginous; ventral scopa white, wings dusky hyaline. Very like *M. hackeri*, but flagellum red beneath; the broad clypeus tridentate, one tooth in the middle, the others at extreme sides; fifth and sixth tergites much less hairy. The male also resembles *M. hackeri*, but flagellum red beneath, and lobes of sixth tergite not so close together. Purnong, Victoria (S. W. Fulton) and W. Australia.

*Megachile fulvomarginata* Cockerell.

Female about 12 mm. long, abdomen parallel-sided; wings hyaline; pubescence, including the scopa, white; clypeus low and broad, its anterior edge straight, with an obscure median nodule; mandibles elongate, the cutting edge covered by a very conspicuous band of golden fulvous hair; tegulae black. Taken in Queensland by Turner. *M. relict*a is allied.

*Megachile fumpennis* Smith.

The female has the aspect of *M. revicta* or *M. lucidiventris*, with dense white hair at base of abdomen, but the anterior wings are strongly infuscated, and the ventral scopa is black. Described from Champion Bay, W. Australia.

*Megachile fuscitarsis* Cockerell.

Male about 14 mm. long; black, including legs and antennae, but anterior basitarsi expanded into an enormous flattened structure, which is dark brown or black, with much white hair on outer side, and has posteriorly a long, thick, black fringe, the base of which has a fringe of short white hair. Anterior wings very dark; hair of face and front light yellow, long and dense; hair otherwise rather dull white, with a good deal of black dorsally; sixth tergite broadly truncate, with a strong median apical spine. Taken by Turner in Queensland. Allied to *M. vestitor* and *M. fabricator*.

*Megachile gahani* Cockerell.

Male about 11 mm. long, looking like *M. cygnorum*, but hair of face pale golden; front not covered with hair; tegulae ferruginous; dark parts of abdomen without black hair, but instead with a fine fulvous tomentum; the broad abdominal hair-bands and the fine tomentum covering sixth and nearly all of fifth tergites quite orange. The anterior tarsi are light yellow. The type, in the British Museum, is labelled "New Holland," but it was collected by Surgeon B. Bynoe, of H.M.S. "Beagle."

*Megachile gilbertiella* Cockerell.

A species near *M. apicata*, recognisable by the characters given in the key. The female is about 8 mm. long; ventral scopa white, fulvous on apical segment. Anterior margin of clypeus with two widely separated short teeth, and a slight prominence in the middle between them. Type taken by Gilbert Turner at Cooktown, Queensland. Also known from Gordonvale (Q.).

*Megachile hackeri* Cockerell.

Also related to *M. apicata*; female 8.5 mm. long, the three clypeal teeth very low and wide spaced; flagellum dark (bright red beneath in *apicata*);



mesothorax anteriorly without any traces of hair-spots; bases of abdominal segments not broadly pilose; sixth segment entirely red. The male is about 7 mm. long; mandibles dark (orange with dark base and apex in *apicata*); flagellum dark; apex of abdomen (sixth tergite, not the morphological apex) with a pair of small tubercles or obtuse teeth (shallowly emarginate in middle, with about four sharp irregularly placed teeth on each side in *apicata*). In both species the anterior tarsi are simple and coxae unarmed. Discovered by Hacker at Brisbane; he has described the nest (Mem. Queensl. Mus., III., 1915, p. 138). (Q.).

*Megachile haematogastra* Cockerell.

Female about 11.5 mm. long, with the ventral scopa bright ferruginous, black on last segment and pale yellow at extreme base. Abdomen not at all metallic, tergites 2 to 5 with narrow entire fulvous hair-bands; face and front with bright fulvous hair, not covering the clypeus; thorax with fulvous hair, but short and black on disc of mesothorax, longer and black on scutellum (but a fulvous band between the two), and blackish on disc of mesopleura; wings dusky. Very distinct from other Australian species, but rather approaching the Solomon Is., *M. shortlandi* Ckll. It was discovered by F. P. Dodd in the Cairns District (Q.).

*Megachile hampsoni* Cockerell.

Female about 14 mm. long; abdomen long and parallel-sided; black, with black, white and orange pubescence, the latter only on the abdomen; ventral scopa long and white, black on last segment and extreme sides of penultimate one. Anterior edge of clypeus straight; hair of front dull pale ochreous, of vertex short and dark fuscous; a conspicuous tuft of white hair just below tegulae; upper part of pleura, mesothorax just above tegulae, and extreme sides of scutellum, with black hair; wings dusky; tergites 2 to 4 with short black hair (except basally, where they are nude), and with narrow but very distinct marginal hair-bands, white at the extreme sides, but otherwise orange; fifth tergite with the marginal band orange, but the orange also invades the disc, leaving the black only at sides; sixth with the base broadly covered with orange tomentum. Taken by J. J. Walker at Fremantle, W.A. Type in British Museum.

*Megachile hardyi* Cockerell.

Male about 9 mm. long; parallel-sided; tegulae dark red; knees, tibiae, tarsi, and anterior femora except a streak above and below, bright chestnut red; thorax above with thin fuscous hair, at sides and behind with white; sixth tergite apically red and obtusely bilobed. Blackheath (G. H. Hardy). I do not give more details, because the full description has recently appeared in Mem. Queensl. Mus., June, 1929, p. 305. It runs in the tables near *M. rufolobata* or *M. latericauda*, but is very distinct. (Q.).

*Megachile heliophila* Cockerell.

Female about 10 mm. long; lower margin of clypeus slightly undulate, obscurely subemarginate in middle; hair of vertex and disc of mesothorax black, and much long black hair mixed with the pale on scutellum; greater part of fifth tergite, and all of sixth, with appressed golden hair; ventral scopa white. Allied to *M. remotula*, but larger, the clypeus differently formed, flagellum not red beneath. Taken at Brisbane by Hacker. In the original description the type is marked male; it is a female. (Q.).

*Megachile henrici* Cockerell.

Female about 14 mm. long; face covered with bright orange-ferruginous hair, and last tergite of abdomen nearly covered by tomentum of the same colour. Thorax with much white hair, a little black intermixed on mesothorax; ventral scopa silvery white, black at sides of last three segments. New South Wales, the type in American Museum of Natural History, from

the collection of the actor and entomologist, Henry Edwards, but understood to have been collected by W. Macleay. It has also been found at Adelaide and Melbourne, and at Lugano, N.S.W. (Q.).

*Megachile heriadiformis* Smith.

Female 11 mm. long, with two small tubercles at apex of clypeus; sixth tergite covered, except at extreme base, with golden-yellow hair; ventral scopa white. The type came from Adelaide, and when I saw it in the British Museum, was headless. There was a specimen from Swan River, of which I noted that the clypeus was broad and squarely produced, and apex of labrum with outwardly directed spines. (Trans. Amer. Ent. Soc., 1905, p. 342). This was probably a different species. Among the Smith species, Meade-Waldo found *M. heriadiformis* nearest to *M. oblonga*, the latter differing by being a little smaller, the apex of clypeus with a small median tubercle, and no fascia on the fourth tergite. (Q.).

*Megachile hilli* Cockerell.

Female about 15.5 mm. long, with the form and aspect of *M. mystacea*, but mandibles with a broad anterior face (separated by a sharp keel from the outer surface) concave and polished; clypeus densely punctured laterally, shining and with very few punctures in middle, the lower margin with a couple of projections (style of *M. placida* Smith, from the Moluccas); sides of face densely covered with black hair, front and vertex densely covered with pure white hair; wings very dark; abdomen densely covered with red hair above and below, but the first segment with black, except along margin. Townsville, Queensland (G. F. Hill). Type in American Museum of Natural History. (Amer. Mus. Novitates, 346, 1929, p. 16).

*Megachile holura* Cockerell.

Male about 9.5 mm. long, with black and white hair, and a large red apical hair patch on abdomen. Related to *M. canifrons*, but with black hair on vertex, mesothorax and disc of scutellum; hair of head and thorax otherwise white. The sixth tergite is very broadly rounded, but produced apically, quite entire. Rutherglen, Victoria (French). Female *M. trichognatha* was also taken at Rutherglen, but the male of that species is known, and differs conspicuously in the structure of abdomen from *M. holura*.

*Megachile horatii* Cockerell.

Male about 13 mm. long; like *M. erythropyga*, but larger, with hair on face pure white; first three tergites with lateral white hair patches; sixth tergite rather more produced; face narrower, with the eyes more parallel. Southern Cross, 260 miles inland from Perth, W.A. (Horace Brown). In connection with the description of *M. horatii* (Entom., 1913, p. 165) is a discussion of the status and characters of *M. erythropyga*, the male being designated as the type.

*Megachile ignescens* Cockerell.

Female 10.5 to 11.5 mm. long, the abdomen more or less metallic, and the ventral scopa bright ferruginous, black on apical part of last segment. Runs next to *M. pictiventris*, but is smaller, and easily known by the white hair-bands on abdomen. Melville Island and Port Darwin (Hill). Type in American Museum of Natural History. (Amer. Mus. Novitates, 346, 1929, p. 6).

*Megachile ignita* Smith.

Male 14 mm. long, with tergites 5 and 6 ferruginous, tergite 6 deeply notched. (Meade-Waldo, from type). Face covered with fulvous hair; wings pale fuscous; anterior tarsi simple, and coxae unarmed. Described from "New Holland."

*Megachile kirbyana* Cockerell.

Male nearly 10 mm. long, superficially much like *M. darwiniana*, the hair being white, with black on vertex, but the anterior legs are simple, except that the coxae have rather short spines. The sixth tergite is covered with white hair, its apical margin red, and irregularly dentate, with about four prominent rounded teeth; extreme anterolateral corners of sixth tergite with a sharp thorn-like tooth; the subapical ventral region shows two long dark red divergent teeth or spines. The tibiae and tarsi and greater part of front femora are red. Taken by Commander J. J. Walker at Freemantle, W.A., and later Turner obtained a long series of both sexes at Yallingup.

*Megachile kurandensis* Cockerell.

Male about 8.5 mm. long, short and broad, the anterior tarsi simple but robust, with long pale fulvous hair behind; face densely covered with golden-fulvous hair; vertex with long black hair; hair of thorax above and pleura mainly black, but fulvous on tubercles, at corners of mesothorax, in scutello-mesothoracic suture, and behind scutellum; tergites 2 to 4 with apical bands of bright golden-fulvous or golden-orange hair, fifth with about the apical two-thirds covered with such hair, and sixth (which is very obtusely binodulose) entirely covered. Taken by Turner at Kuranda, Queensland. Type in British Museum. It may be compared with *M. sequior*, but that has a pair of well developed teeth on sixth tergite.

*Megachile latericauda* Cockerell.

Male about 11 mm. long; fifth tergite densely covered with bright red hair, except at extreme sides; sixth without red hair, its transverse keel with two broad rounded lobes, the margins of which are more or less irregular or nodulose. Vertex and disc of thorax, including anterior part of scutellum, with dark chocolate hair; anterior tarsi red, moderately expanded. Female with legs entirely black; fifth and sixth tergites covered with deep coppery red hair except at sides; ventral scopa entirely white. Swan River, W.A. (J. Clark). Near to *M. ferox*, but easily separated by the male antennae (not at all expanded at apex), which are like those of *M. erythropyga*, a species having entirely different male tarsi. The female resembles *M. heliophila*, but differs by the colour of hair at end of abdomen, the entirely opaque mesothorax, the much more finely punctured clypeus, and the minutely and very densely punctured supraclypeal area. (Q.).

*Megachile latipes* Smith.

A well known species, recognisable by the key, and probably the male of *M. lucidiventris*. The male is 13 mm. long, the face covered with fulvous pubescence, the anterior legs modified, with dilated tarsi and armed coxae. It was described from "New Holland," but is now known from Adelaide, Sydney, and various places in Victoria. (Q.).

*Megachile leeuwinensis* Meade-Waldo.

Female 11 mm. long; head, thorax and abdomen for the most part clothed with fulvous-grey pubescence; tergites 4 to 6 almost completely dusted with such pubescence; apex with tegument red; clypeus with emarginate apex. Male with second joint of anterior tarsi conspicuously dilated; hair of head and thorax fulvous grey. Rather like a large *M. apicata*. Taken by R. E. Turner at Yallingup, W.A.

*Megachile leucopogon* Cockerell.

Male about 7 mm. long; mandibles and legs all black; face and front densely covered with long pure white hair. Allied to *M. cetera*, but apparently not its male. From the male of *M. timberlakei* it differs by the rounded (not dentate) apical lobes of abdomen, and the much shorter and



broader hind basitarsus. The middle tarsi have very long white hair behind, which is not true of *M. timberlakei*. Port Darwin (G. F. Hill) and Thursday Island (Alice Mackie). Type in American Museum of Natural History. (Amer. Mus. Novitates, 346, 1929, p. 6).

*Megachile leucopyga* Smith.

Female 11.5 mm. long; apex of clypeus simple; hair of vertex and disc of thorax fuscous; apex of abdomen with an ovate patch of pale pubescence, slightly tinged with yellow; ventral scopa very pale yellow or nearly white. Tasmania. Type in British Museum. (Q.).

*Megachile lineatipes* Cockerell.

Male about 10.5 mm. long. Close to *M. phenacopyga*, but distinct by the anterior legs, the coxae with long curved spines, the femora ferruginous (blackened behind apically), greatly flattened and expanded, sharply keeled below, and obtusely angulate toward base, the basal half of the broad inner surface with fine zebra-like black lines or stripes; tibiae and tarsi also modified, the tarsi cream-colour, flattened and expanded, with an oval reddish lobe. Compared with *M. chrysopyga*, it has the anterior tarsal lobe paler and much more reduced. From *M. latipes* it is especially known by the two sharp teeth at end of abdomen. Kuranda, Queensland (Turner). Type in British Museum.

*Megachile longiceps* Meade-Waldo.

Female 8.5 mm. long; very like *M. apicata*, but easily separated by the long narrow head, of which Meade-Waldo gives a figure. The clypeus is normal, without the tubercles of *M. clypeata*. The sixth tergite and sternite are reddish; scopa silvery white. Yallingup and Busselton, W.A. (R. E. Turner). Type in British Museum.

*Megachile lucidiventris* Smith.

A well known species with dusky wings, and the abdomen white-haired at base; ventral scopa white. It can be recognised from the characters given in the key. The locality was given as "New Holland," but it has frequently been collected in New South Wales and Victoria. (Q.).

*Megachile mackayensis* Cockerell.

Female about 12 mm. long; resembles *M. erythropyga*, but the red abdominal patch is larger (covering fifth and sixth and more than apical half of the fourth tergites), and the basal tergites have no white hair-bands. Ventral scopa creamy-white, dark fuscous on last segment, and penultimate except at base. Male about 10 mm. long, face and front covered with bright rufo-fulvous hair. Compared with *M. erythropyga* the male has a smaller head, the mesothorax more densely and minutely punctured, the sixth tergite not distinctly concave above in lateral view. Also near *M. beutenmulleri*, but separated by the ornamentation of the abdomen. Mackay, Queensland (Turner); type in British Museum. Also found in New South Wales. (Q.).

*Megachile macleayi* Cockerell.

Female a little over 17 mm. long; wings dark, shining purple; seen from above the only conspicuous pubescence is snow-white, covering scutellum and metathorax, and a bright orange-red patch covering the fifth and sixth, and a large part of the fourth, tergites. Ventral scopa creamy-white, fuscous on last two segments. The head is massive, with very broad face. New South Wales (Macleay). Type in American Museum of Natural History. Also found at Hughenden, Queensland. (Q.).

*Megachile macularis* Dalla Torre.

A common species from Victoria to Queensland, recognisable by the key. The name was substituted for *M. maculata* Smith, preoccupied. Smith



described both sexes, and gave Western Australia as the locality. The name was derived from the spots of ochraceous or white hair on thorax above. (Q.).

*Megachile micrerythrura* Cockerell.

Female 7 mm. long; head and thorax black, abdomen red, the colour tegumentary; ventral scopa entirely creamy-white. Allied to *M. abdominalis*, but smaller and narrower, with proportionately longer eyes. In size and shape it resembles *M. semicandens*. Male similar; anterior tarsi and coxae simple; sixth tergite broadly emarginate or very obtusely bilobed (in *semicandens* it is bidentate). Port Darwin (Turner). Type in British Museum.

*Megachile modesta* Smith.

Described by Smith from both sexes in the collection of Sir John Lubbock. Meade-Waldo describes the female as 11 mm. long, the sixth tergite, and fifth apically, with pale fulvous pilosity. He places it in a group of relatively slender species, with white hair at sides of face. Hacker, in his catalogue, gives Mackay as a locality, basing this on my record in Ann. Mag. Nat. Hist., June, 1906. But in Bull. Amer. Mus. Nat. Hist., I reported *M. modesta* from New South Wales, and expressed the opinion that the Mackay insect was really *M. apicata*. The male *M. modesta*, according to Smith, has the two basal joints of the anterior tarsi white, flattened and expanded; the sixth tergite is truncate, with a minute tooth at extreme base of lateral margins.

*Megachile monstrosa* Smith.

A very large species, female 21 mm. long; very massive head, the apex of clypeus with lateral tubercles; wings fuscous; first tergite with white hair; ventral scopa creamy-white. The type locality is Champion Bay, W.A., but F. P. Dodd found it at Townsville, Queensland. (Q.).

*Megachile mundifica* Cockerell.

Female about 11.5 mm. long; black, including antennae, legs and tegulae; sides of face, front, and the broad cheeks with abundant white hair; middle of clypeus with a very large squared excavation, within which are golden hairs, and on each side of which the margin has the aspect of a broad rounded lobe; scutellum and disc of mesothorax with red-brown hair; abdomen covered with pale fulvous hair from apical margin of fourth tergite to end. National Park, Queensland (Hacker). Allied to *M. recisa*. The clypeus is entirely different from that of *M. simpliciformis*. (Q.).

*Megachile mystacea* Fabricius.

A very well known species, the abdomen covered with short red hair, and the wings fuliginous. The male is much smaller and more slender than the female, and has a fringe or beard of pure white hair over the mouth. The end of the abdomen is without spines. It is common in various parts of Queensland, and I have taken it on Thursday Island. It is also known from Port Essington, N.T. Friese (Deutsch. Ent. Zeit., 1920, p. 53) described a female collected by Turner at Mackay as *M. mystacea* var. *nitidiscutata*, the thorax black haired, face white haired, mandibles large, strongly quadridentate, etc. From the description of the punctuation of the head, I believe it was *M. ustulata*. (Q.).

*Megachile nasuta* Smith.

Meade-Waldo gives the following from Smith's type (Champion Bay, W.A.); female 12 mm. long, clypeus porrect, the apex semicircular; face sparsely clothed with grey hairs; abdominal tergite 6 with golden pubescence. In 1915 he recorded that Turner collected fourteen females at Yallingup, W.A. In 1910 I described a subspecies *M. nasuta argentifer*, the first two tergites with white hair (only first in *nasuta*), the others with short black hair; a large round patch of orange-ferruginous hair on last tergite, in-

vading the apical margin of the one before; ventral scopa entirely silvery-white, with a slight creamy tint (pale fulvous in *nasuta*). The great clypeal prominence is as described for *nasuta*, except that its margin is only very feebly crenulate. This form comes from Melbourne, the type being in the Berlin Museum.

*Megachile nigrovittata* Cockerell.

Male slightly over 8 mm. long, small and narrow, the last three tergites covered with orange tomentum, the apex briefly bituberculate. It may be compared with such species as *M. modesta*, but is easily known by the remarkable anterior legs, as follows: Tibiae shining black, with an apical creamy-white patch; tarsi white, broadly expanded, the first three joints forming a very large oblong structure, concave beneath, having on its upper surface a long black streak parallel with the anterior edge, tapering apically, and sending out two oblique branches anteriorly; there is also a dark red-brown band extending round hind margin of the first joint only; beneath there are near the middle two oblong black spots, which show merely as bluish shades on the upper surface; fourth and fifth joints much smaller, but also broadened, the fifth with a lateral-projection; claws white. The type, in British Museum, is labelled N.W. Coast of Australia, but it also bears the numbers 69, 50, which signify "purchased from Mr. Du Boulay, collected in W. Australia, Nicol Bay, Swan River and Champion Bay."

*Megachile oblonga* Smith.

Meade-Waldo, in his key to Smith's species, couples this with *M. heriadiiformis*, from which he separates it (female) by the apex of clypeus with a small median tubercle (instead of two tubercles), and absence of fascia on fourth tergite. It is 10 mm. long. Smith records a patch of bright fulvous hair on fifth and sixth tergites; scopa white. Western Australia. Type in British Museum.

*Megachile obtusa* Smith.

Smith describes the male as  $3\frac{1}{4}$  lines long; head large, face covered with bright yellow hair; antennae rufotestaceous beneath; cheeks, legs and thorax beneath with long white hair; thorax above with pale yellow hair; anterior tarsi pale yellow testaceous, the basal joint slightly dilated, and of the same width throughout, the posterior margin thinly fringed with white hair, as are the middle tarsi behind; apical tergite bidentate, and covered with bright yellow pubescence. W. Australia, in the W. W. Saunders collection, the type now in the Hope Museum at Oxford. Meade-Waldo records that Turner took nine females and seven males at Yallingup.

*Megachile oculipes* Cockerell.

Described from the male, and recognisable by the characters given in the key. It is about 10 mm. long; the red scape, thick red middle tibiae (with a broad black band behind), and other characters readily separate it from *M. vestitor*, *M. lineatipes* and *M. latipes*. In Entomologist, 1913, p. 168, it is suggested that this may possibly be the male of *M. aurifrons*. The type was taken at Townsville, by F. P. Dodd, and is in the British Museum. The species is now known to be very widely distributed, occurring in New South Wales, and at Perth, W.A.

*Megachile oppidalis* Cockerell.

Male 13 to 15 mm. long, with the aspect of *M. fumipennis*, but with dark hair on thorax posteriorly (at most pallescent laterally), larger scutellum, and much finer sculpture of mesothorax. The sixth tergite has a pair of rounded lobes and a deep depression between them. The abdomen has black hair beneath, and presumably the female has a black scopa. Found by G. F. Hill at Townsville, Queensland. Type in the Melbourne Museum.

*Megachile ordinaria* Smith.

Female 11 mm. long; in Meade-Waldo's key it is coupled with *M. modesta*, from which it is separated by the sixth tergite having short griseous pilosity. The margin of the clypeus is slightly emarginate. Apical margins of tergites with narrow white hair-bands, more or less obliterated on basal segments. Known only from Tasmania. (Q.).

*Megachile pararhodura* Cockerell.

Male 10 mm. long; very near *M. rhodura*, but tergites 3 to 6 have the tegument chestnut-red, a darker tint than the red of *rhodura*; the abdomen is broader, and the large apical lobes are wider apart; the tarsi have longer and more abundant hair, and the yellowish-white hind tibial spurs are very much larger. Anterior coxae and tarsi simple. Mackay, Queensland (Turner). Type in British Museum.

*Megachile phenacopyga* Cockerell.

Male 11 mm. long; very like *M. chrysopyga*, but face broader, the dense hair covering it pale yellowish, shining white on clypeus; apex of anterior femora and outer side of tibiae not black, but with a little blackish stain; anterior tarsi cream-colour, broadly dilated, the first joint fringed on inner side with fuscous hairs, the others with ferruginous, the long white hair of the hind margin tipped with black or fuscous. The type, taken by Ludwig Preiss, is in the Berlin Museum. In Entomologist, 1913, p. 165, it is recorded from Waroona, W.A., and there is a discussion of its relationship with *M. ignita*. In Ann. Mag. Nat. Hist., August, 1926, p. 222, it is recorded from Broad Meadows, Victoria.

*Megachile pictiventris* Smith.

This well known species, with metallic, bandless, abdomen, and red ventral scopa, is readily recognisable by the key. Smith described it in 1862 as *M. senex*, and in 1879 as *M. pictiventris*, the type in each case coming from the Richmond River. The name *M. senex* being preoccupied. Dalla Torre substituted *M. secunda*, not being aware that *M. pictiventris* was the same. It appears to be common in Queensland, and enters New South Wales. (Q.).

*Megachile preissi* Cockerell.

Female about 8 mm. long, close to *M. clypeata*, with distinctly dusky (though not dark) wings, femora and anterior tibiae ferruginous in front; abdomen very dark reddish; the extremely dense punctures of head and thorax above minute; the abdomen also has very narrow but entire marginal hair-bands. Ventral scopa entirely white. The clypeus has a median tooth and a large process on each side. Collected by Preiss, type in Berlin Museum. Meade-Waldo includes it in his key in Ann. Mag. Nat. Hist., March, 1915, p. 327. This and several other bees from Preiss are labelled Eastern Australia, but this may be a mistake; Preiss spent four years in Western Australia, where he discovered many new plants, nearly a hundred species being named after him. He came to Swan River in 1838.

*Megachile pretiosa* Friese.

This handsome species, from Cairns, Queensland, was figured by Friese as *M. albobasalis*, but later separated, the thorax being without white hair. The female is 16 mm. long, the wings dark, the abdomen with dense white hair at base, red at side and apex. (Q.).

*Megachile punctata* Smith.

Briefly described from a male, 4 lines long, labelled New Holland, in the collection of J. S. Baly. The face is covered with pale yellow hair, brightest on clypeus; wings fuscous, hyaline toward base; abdomen naked,



strongly punctured, having on each side of first tergite a spot of snow-white hair; apex notched in middle. Meade-Waldo states that it is 13 mm. long, the anterior tarsi and coxae simple. It differs from *M. rugosa* by having the first tergite with small apicolateral tufts of white hair, whereas in *rugosa* the first tergite is wholly clothed with white, and the second has white hair at sides of apex.

*Megachile quinquelineata* Cockerell.

A well known species, recognisable by the key. *M. glaberrima* Friese is a synonym. The type, in the British Museum, was taken by Turner in the Mackay district, but it has been found as far north as Cape York and south to Melbourne, as well as in Western Australia. It is figured in Tillyard's Insects of Australia and New Zealand, p. 304. (Q.).

*Megachile ramulipes* Cockerell.

Male about 10 mm. long, somewhat related to *M. rhodogastra*, but easily separated by the long slender anterior tarsi. Other characters are given in the key. Kewell, Victoria.

*Megachile recisa* Cockerell.

Male about 10 mm. long; related to *M. modesta*, but anterior tarsi light red, slightly broadened, the third joint beneath with an intense black oval spot. The anterior coxae have rather short stout spines in the midst of long white hair. For other characters see the key. Type from Kewell, Victoria, but also found at Brisbane. (Q.).

*Megachile relicta* Cockerell.

Female 10 mm. long; hoary with white pubescence; flagellum bright ferruginous beneath; clypeus transversely swollen or obtusely ridged, coarsely punctate above, below, where it slopes inward, shining and scarcely punctured, the lower margin with two large, widely separated triangular teeth; wings clear; ventral scopa entirely white. By the pruinose abdomen it resembles *M. fulvomarginata*, by the clypeal structure *M. clypeata*. Tennants Creek, South Australia (Field).

*Megachile remeata* Cockerell.

Female a little over 12 mm. long, closely resembling *M. semiluctuosa*, but with bidentate mandibles, slightly instead of strongly arched margin of clypeus, much more finely and minutely punctured mesothorax, and shining finely punctured abdomen. The clypeus is subcarinate in middle, with a tooth on middle of lower margin. Ventral scopa white, with a few hardly noticeable dark hairs at extreme apex. W. Australia (Duboulay).

*Megachile remotula* Cockerell.

Female 10 to 11 mm. long, with mostly white (not abundant) hair, the last two tergites covered, except at sides, with appressed shining orange-fulvous hair. Clypeus densely punctured, its upper part with a median raised line, its lower margin quadridentate, the teeth small, the inner pair only clearly dentiform; flagellum ferruginous beneath; wings dusky; hind spurs peculiar, blunt, with a little apical claw-like hook; first tergite with a patch of white hair on each side, 2 to 4 with narrow white apical hair-bands; ventral scopa all white. Allied to *M. ferox*. Collected by Preiss. Type in Berlin Museum. Meade-Waldo includes it in his key in Ann. Mag. Nat. Hist., March, 1915, p. 327.

*Megachile resinifera* Meade-Waldo.

Female 16 mm. long; hair of vertex and disc of mesothorax fuscous, of front, cheeks, pleurae and metathorax griseous; first two tergites with white apical hair-bands, and third with white hair at sides; sixth with a patch of ferruginous hairs; scopa black; wings subhyaline. Male very different, 15 mm. long, having only lateral spots at apex of first two ter-



gites; anterior tarsi flattened, not dilated, ferruginous to ivory-white; tergite 7 black, concave, but curled out toward apex, which is serrate. Discovered by R. E. Turner at Yallingup, W.A. The females were burrowing in sandy banks; some had large globules of gum (evidently from *Eucalyptus*) in their mandibles. Specimens of *M. nasuta* were also observed carrying gum. (Q.).

*Megachile revicta* Cockerell.

Female 15 mm. long; wings with apical half brown, the basal hyaline; differing from *M. fabricator* by the third tergite without hair-bands or spots, and in the mandibles, which are extremely broad and massive, quadridentate, but the innermost tooth feeble, a line of ochreous hair running parallel with the cutting edge. The mesothorax is densely and coarsely rugoso-punctate, almost like a *Lithurgus*. Ventral scopa entirely creamy-white. For other characters see the key. Sixty miles north of Perth, W.A. (C. French).

*Megachile rhodogastra* Cockerell.

Male 11 mm. long, with tegument of sixth tergite, apical margin of fifth broadly, and ventral surface of abdomen clear ferruginous; the fifth and sixth tergites (except basal margin of fifth narrowly) are covered with short scale-like yellowish hair, and also bear much erect yellow hair. Face densely covered with creamy-white or yellow hair; mesothorax and scutellum with black hair, but some white in the suture between them and just behind tegulae; wings strongly infuscated; sixth tergite rather obtusely bispinose. Related to *M. rhodura*, but much more robust, with the abdominal punctures less dense and very much smaller, and the wings much darker. Hacker notes that in fresh specimens the hair on sides and apex of abdomen is orange. The anterior tarsi are stout but simple. Hacker bred both sexes from a nest found in an iron pipe, and the nest was found at Townsville by G. F. Hill. Pieces of leaves are used as in typical *Megachile*. The female is described in Ann. Mag. Nat. Hist., September, 1922, p. 267. It has the ventral scopa white on first segment, otherwise bright ferruginous, black only at extreme tip. The abdomen has distinct metallic tints, and this, with the red scopa, separate it at once from *M. heliophila*. The type was collected by Turner at Mackay, and is in the British Museum. I collected a specimen at Sherwood, near Brisbane. (Q.).

*Megachile rhodura* Cockerell.

Both sexes can be identified from the key. The type is a male, 9 mm. long, taken by Gilbert Turner in the Mackay district, and now in the British Museum. The apex of the abdomen is emarginate. The female was taken at Mackay at flowers of *Eucalyptus*, and is about 12.5 mm. long, with large oblong head, the eyes slightly diverging below; middle of lower edge of clypeus with a small nodule, defined by a notch on each side; ventral scopa entirely white. Other localities are Caloundra and Brisbane. (Q.).

*Megachile rowlandi* Cockerell.

Female broad, with metallic abdomen and red scopa. I had confused it with *M. pictiventris*, but it is more robust, with white hair-bands on the abdomen. It was taken in the Mackay district by Turner.

*Megachile rufapicata* Cockerell.

Female slender, hardly 10 mm. long, with white ventral scopa; last tergite dull red. Sides of face with very dense and conspicuous patch of white hair. Taken by W. D. Campbell in North Queensland; the type in the Australian Museum.

*Megachile rufolobata* Cockerell.

Male about 14 mm. long, with the fifth and sixth tergites bright ferruginous red. Allied to *M. ignita*, but anterior coxae with short, stout, sharp

spines (unarmed in *ignita*); vertex, a large discal patch on mesothorax, and anterior part of scutellum with fuscous hair; face with golden hair, but all the other pale hair clear white. The tarsi have long white fringes. Sixty miles north of Perth, W.A. (C. French).

*Megachile rufopilosa* Friese.

Male 9 mm. long; described as being like *M. fimbriventris* Friese (from Fiji and Tonga Island), but sixth tergite thickly red-haired and second sternite flat and shining. Fremantle, W.A. (Frank). *M. fimbriventris* is a synonym of *M. scutellata* Smith (Ann. Ent. Soc. Amer., xvii., 1924, p. 392). *M. rufopilosa* was published in Deutsch. Ent. Zeit., 1911, p. 453, but was omitted from Hacker's Catalogue.

*Megachile rugosa* Smith.

Male 11 mm. long; the description indicates a species very like *M. punctata*, but wings hyaline with a slight fuscous cloud apically, and a darker stain in marginal cell. Meade-Waldo couples it with *punctata*, separating it by the wholly white haired first tergite and the white hair at sides of apex of second. Anterior tarsi and coxae simple. Western Australia. Type in British Museum.

*Megachile semicandens* Cockerell.

Male about 7 mm. long, the abdomen beyond the second segment entirely bright apricot colour. The second segment has the hind margin red, and three suffused spots, one in the middle and one on each side, confluent with the red of the margin; tibiae and tarsi reddish brown, the anterior tibiae ferruginous in front; anterior tarsi and coxae simple; sixth tergite vertical. Found by Schomburgk at Adelaide. Type in Berlin Museum.

*Megachile semiclara* Cockerell.

Female about 17.5 mm. long; very robust, mandibles massive, with four large teeth; wings with more than basal half hyaline, the apical part fuscous; basal tergite with black hair, but second and third with conspicuous bands of pure white hair, fourth with a spot of white hair at each side; scopa pure white, black at extreme apex. Cairns, Queensland (A. P. Dodd). (Mem. Queensl. Museum, June, 1929, p. 303). (Q.).

*Megachile semiluctuosa* Smith.

Well known, and easily recognised by the key. The female is 18 mm. long; first two tergites with white hair. Meade-Waldo places it in *Eumegachile*, next to the larger *M. monstrosa*. Smith describes both sexes; Adelaide is the type locality, but the species extends to Western Australia, and eastward to Victoria, where it seems to be common. (Q.).

*Megachile sequior* Cockerell.

Male nearly 10 mm. long, superficially very like *M. cygnorum*, but distinguished by the simple anterior tarsi; sixth tergite swollen in the middle toward base, its margin truncate, with a rather large rounded black tooth at each corner of the truncation. Although the front tarsi are simple, their coxae have short spines. Female about 11.5 mm. long; thorax six-spotted (as also in the male); ventral scopa white, black on last segment. The female could be taken for *M. macularis*, but may be separated by the black hairs, which project at sides of abdomen being confined to the fifth and sixth segment. The type, in the Berlin Museum, is labelled Adelaide (Schomburgk). I have reason for thinking that it was really a Schultzean specimen from Port Darwin, which passed through Schomburgk's hands. Turner took it at Port Darwin, December, 1902. (Q.).

*Megachile sericeicauda* Cockerell.

Male 9 to 10.5 mm. long, without any red at apex of abdomen; face densely covered with fulvous hair; labial palpi with the first joint robust

and dark, the others pallid; hair on anterior middle of mesothorax black or dark fuscous; wings strongly dusky; anterior tarsi and coxae simple, the latter very hairy; a dense triangular patch of pure white hair at each side of first tergite; no hair-bands on abdomen; middle of sixth tergite with appressed silky-white hair, and margin very obtusely bilobed, the actual margin (beneath) with a pair of angular projections. Known from *M. austeni* by the large distinct punctures of the abdomen. Type in British Museum; collected by Turner in the Mackay district.

*Megachile serricauda* Cockerell.

Male about 8 mm. long, rather robust, resembling the group of *M. macularis*, *sequior*, *cygnorum* and *kurandensis*, but the thorax without hair-spots, and the margin of sixth tergite strongly but irregularly dentate or serrate, with a rounded central emargination. Compared with *M. kurandensis*, the antennae are shorter in proportion, and the ocelli are quite different, being wide apart, the interocellar distance a little greater than the distance from ocelli to eye and much greater than that to occipital margin. Type from the Mackay district (Turner), in British Museum. The nest is briefly referred to in *Entomologist*, 1913, p. 168. The species is widely distributed, south to Victoria, and to Western Australia (Perth). (Q.).

*Megachile sermaculata* Smith.

Female 13 mm. long; robust, the face with golden hair. The abdomen has six white hair-spots, and the apex is ferruginous. Scopa silvery white. Type from Champion Bay, W.A., in British Museum. Turner took it at Perth and Yallingup.

*Megachile simplex* Smith.

Female 10 mm. long, all the tergites black, with narrow apical bands. The size proves to be variable; a female from Brisbane is about 8.5 mm. long, and one from Ararat, Victoria, reaches 12 mm. The ventral scopa is white. The type, in the British Museum, is labelled New Holland, and said to be from Hunter's collection. (Q.).

*Megachile simpliciformis* Cockerell.

Female about 11 mm. long; like *M. simplex*, but clypeus very densely and finely punctured; vertex more depressed, the head little elevated above the eyes; clypeus emarginate in middle of lower edge, with a tuft of orange hair showing in the emargination. Ventral scopa all white. Stradbroke Island, Queensland (Hacker). The date of publication is 1918, not 1908, as given in Hacker's Catalogue. (Q.).

*Megachile speluncarum* Meade-Waldo.

Female 12 mm. long; face and thorax more or less densely clothed with griseous hair; tergites 1 to 3 with narrow apical bands of the same; tergites 5 (except base and sides) and 6 bright ferruginous red; scopa silvery white, fuscous at apex. Clypeus very short, deeply emarginate, sides of the emargination forming distinct sublaminate processes. Wings subhyaline. Yallingup, W.A. (R. E. Turner). Type in British Museum.

*Megachile stalkerii* Cockerell.

Female about 9 mm. long, rather like *M. pararhodura*, but much smaller. Abdomen with the first two tergites and extreme base of third black, the rest with the tegument deep chestnut red, with scanty white hair. Flagellum bright red, black at apex above. Ventral scopa all white. The best characters are in the clypeal region, which is extremely peculiar; a large blunt spine, directed obliquely downwards and outwards, projects from the supraclypeal area; sides of clypeus produced into broad outwardly-directed lamellae, which are triangular and pointed; disc of clypeus shining, ap-



pearing deeply sunken between the great lamellae, the excavation suboval in form. Alexandria, N. Australia (W. Stalker). Type in British Museum.

*Megachile subferox* Meade-Waldo.

Female 11 mm. long, very near to *M. ferox*, but distinguished by the ovate (instead of subparallel-sided) abdomen; tergite 6 (and sometimes 5 at extreme apex) with red hair. Both have the clypeus truncate at apex, and with no median raised line. The male is 11 mm. long; the anterior tarsi simple; sixth tergite concave above, rounded and bilobed at apex. In the same paper (Ann. Mag. Nat. Hist., March, 1915), Meade-Waldo describes the female of *M. ferox* (p. 332) for comparison. It has tergites 5 and 6 with red hair-patches. *M. subferox* was taken at Yallingup and Busselton, W.A., by Turner, and the type is in British Museum. (Q.).

*Megachile suffusipennis* Cockerell.

Female 12-13 mm. long; wings fuscous, hyaline at base; pubescence white, including the scopa; anterior margin of clypeus straight; scutello-mesothoracic suture with two transverse marks of white tomentum; abdomen bandless, first tergite with a conspicuous tuft of white hair on each side. Resembles *M. lucidiventris*, which differs by the fuscous hair of clypeus, ferruginous spurs, etc. A coloured figure, purporting to be *M. suffusipennis*, is given by Nicholson in Australian Zoologist, November, 1927, pl. 1, for comparison with the Asilid fly, *Cyanonedys leucura* Herm. Judging from the amount of white hair on the base of the abdomen, this figure really represents *M. lucidiventris*. Hacker has described the male of *M. suffusipennis*; 11 mm. long, the face densely clothed with long golden hair. He found both sexes at flowers of *Daviesia ulicina*. The type, in the British Museum, was obtained by Gilbert Turner in the Mackay district, but the species is widely distributed in Queensland. In the British Museum, I found *M. suffusipennis* (female) placed as a synonym of *M. punctata* (male). But Smith's *punctata* male is larger and more robust than my *suffusipennis* female, and the abdomen is more heavily and closely punctured. A much smaller male in the Museum has the abdomen punctured as in *suffusipennis* female, and evidently belongs to it. (Q.).

*Megachile tasmanica* Cockerell.

Male about 7.6 mm. long; clypeus with a dense beard of pure white hair, but upper part exposed; anterior tarsi formed essentially as in *M. leeuwinensis*, the lobe on second joint large, oval, with a large black spot on a white ground. It is easily separated from *M. leeuwinensis* by the wholly black abdomen. On account of the dusky greyish wings, with stigma and nervures black, it cannot be the male of *M. ordinaria*, which has hyaline wings with ferruginous nervures. The type was found by F. M. Littler at George Town, Tasmania, but it extends north to Brisbane.

*Megachile tenuicincta* Cockerell.

Female nearly 10 mm., male about 8 mm. Both sexes run near *M. palmarum*, but are easily separated by the pubescence, especially the long black hair on the head and the thorax above. In this feature it resembles *M. quinquelineata*, from which it is easily separated (female) by the dense white hair forming the posterior fringe of the hind tarsi. By the tarsal hair it falls rather with *M. cetera*, which lacks the long black hair on the thorax above, and has a median smooth line or band on the clypeus. (Amer. Mus. Novitates, 346, 1929, p. 7). Port Darwin (Hill). Type in American Museum of Natural History.

*Megachile tomentella* Cockerell.

Male about 8 mm. long; one of the small *Heriades*-like forms, superficially similar to *M. nigrovittata* and *M. rhodura*, and also allied to *M. victoriae*, *M. erythropyga* (but hair of face perfectly white) and *M. cant-*



*frons* (but end of abdomen different). Anterior tarsi simple; wings hyaline, with black nervures; no hair-bands on abdomen, but fifth tergite and base of sixth covered with orange tomentum, a few orange hairs also on hind margin of fourth; apex of sixth tergite (that is, the terminal part, or apparent apex) broadly emarginate. The anterior coxae are without spines. Swan River (Du Boulay). Type in British Museum. It also occurs in Victoria.

*Megachile trichognatha* Cockerell

Female about 10 mm. long; head oblong; cutting edge of mandibles densely fringed with orange-fulvous hair; clypeus with a small snout-like median apical elevation; ventral scopa all white. Related to *M. fulvo-marginata*, but smaller, with the cheeks much more densely punctured (more or less grooved), the median process of clypeus larger, and hind spurs yellowish-white. Male about 8 to 8.5 mm. long; the white hair of head, thorax, legs and under side of abdomen abundant and quite long; flagellum clear ferruginous beneath; wings clear, nervures and stigma ferruginous; last two tergites with pale orange hair, and scattered very long white ones; sixth with a broad emargination, the angles bordering the emargination sharp and dentiform, there is also a very small median denticle. The male differs from *M. tomentella* by having the anterior coxae with well developed though short spines, the flagellum red beneath, the ferruginous nervures, etc. Adelaide (Schomburgk). Type (female) in Berlin Museum. It has since been found in Victoria, and Turner took a long series of both sexes at Kalamunda and Perth, W.A. (Q.).

*Megachile trichognatha testicauda* Cockerell.

Female about 8 mm. long, with the median clypeal elevation very small or absent, lower margin of clypeus rather obscurely crenulate; flagellum bright ferruginous beneath; punctures of upper part of head and thorax conspicuously larger. The fifth and sixth tergites and the hind margin of fourth are almost entirely covered with fulvous hair; the tegument of hind margin of fifth tergite is narrowly red. Allied to *M. eucalypti*, but smaller, with the antennae differently coloured, and not so much of the abdomen fulvous-haired. Superficially, it looks like an unusually slender *M. gilbertiella*. Probably a distinct species. Mackay district, Queensland (Turner). Type in British Museum.

*Megachile ustulata* Smith.

A well known species, with the vertex shining and sparsely punctured, the wings fuliginous, and the abdomen with short red tomentum. It looks like *M. mystacea*, but the red of the abdomen is a shade darker, with two dusky bands on basal half. It is widely distributed in Queensland. (Q.).

*Megachile ustulatiformis* Cockerell.

Male about 13 mm. long, more robust than *M. mystacea*, and yet not to be considered the male of *M. ustulata*, having the vertex densely punctured and the second cubital cell shorter. The anterior tarsi are ferruginous, moderately flattened, with an even fringe of pure white hair behind, and curled dark hairs on first joint in front, the anterior apices of the joints produced. The rufo-fulvous hair covering the abdomen is not so bright as in *M. mystacea*, and there is an appearance of darker apical bands on first three tergites. Kuranda, Queensland (Turner). Type in British Museum. I collected it on Thursday Island.

*Megachile vestitor* Cockerell.

Male 9.5 to about 14 mm. long (the larger size typical), resembling *M. lucidiventris* in size, form, and the arrangement of the pubescence, but wings clear hyaline, except the apical field of anterior ones, beginning about the end of the first cubital cell, which is occupied by a rufo-fuscous cloud,

dilute below, but dark above, in and beyond the marginal cell. The venation also differs from that of *M. lucidiventris*; the basal nervure falling considerably short of the nervulus, and the second cubital cell much shorter. Collected by Preiss; the type in Berlin Museum. It was also obtained in W. Australia by Du Boulay. It seems probable that this should not be separated from *M. fabricator*, which it resembles in the structure of the abdomen.

*Megachile victoriae* Cockerell.

Male about 7.5 mm. long; originally described as having no apical hair-patch on abdomen, but in fresh specimens the patch is very distinct, orange-red, covering fifth tergite, except at sides, and slightly invading fourth and sixth. It is closely allied to *M. tomentella*, differing by the flagellum dusky red beneath, and well developed white hair-bands, broadly interrupted in middle, on tergites 1 to 3. It seems to be rather common in Victoria. Rayment (Victorian Naturalist, July, 1928) gives an interesting account of the nesting habits of some species of *Megachile*, and figures the nest of *M. victoriae*, showing that it is a typical leaf-cutter. In this article he figures a rose leaf cut by *M. ferox*, and has a couple of excellent plates, showing structural details of *M. chrysopygæ*, *M. suffuspennis*, and *Lithurgus atratiformis*.

*Megachile viridinitens* Cockerell.

Female with the size and aspect of *M. fumipennis*, with much white hair at base of abdomen, and black ventral scopa. It is easily distinguished by the entirely black hair of face, and strong green tints of the abdomen. The wings are fuliginous. Cairns, Queensland, collected by Dr. W. M. Wheeler. Type in Museum of Comparative Zoology, Harvard University.

*Megachile waterhousei* Cockerell.

Female about 13 mm. long, width of abdomen 5 mm.; pubescence white, abundant and quite long on front, sides of face, cheeks, pleura and meta-thorax, and forming a spot above each tegula; hair black or dark fuscous on vertex, a little on the practically nude mesothorax, and some black also on ventral surface of thorax; wings slightly dusky; hind basitarsus broad and flat, the hair on its inner side yellowish fuscous; abdomen with five white hair-bands; ventral scopa white, black on last segment, and some black at extreme sides of third and following segments. Mackay district, Queensland (Turner). Type in British Museum. It is a broad species like the American *M. latimanus*. The hind spurs are black, not red as in the smaller *M. quinquelineata*.

*Megachile wilsoni* Cockerell.

Male about 7 mm. long; *Heriades*-like, parallel-sided, mandibles (except the bidentate apex), scape, tegulae and legs bright chestnut red; face and front densely covered with long white hair; hair of thorax white; anterior tarsi and coxae simple; abdomen with distinct hair-bands, which are pale fulvous in middle, white at sides; on first tergite the band is reduced to large lateral patches, and it is widely interrupted on second; keel of sixth tergite obtusely bilobed; margins of segments at sides with the tegument red, but the apical segments are not red. Easily known from *M. victoriae* by the red legs. Kiata, Victoria (F. E. Wilson). Type in Queensland Museum.

## AUSTRALIAN EMPIDIDAE.

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*Introduction.*—During 1918 and subsequent years I compiled all literature available on described Australian TABANOIDEA, ASILOIDEA and EMPIDOIDEA, and from time to time worked out the identity of genera and species, publishing catalogues resulting from these researches. Several families are intentionally omitted; the TABANIDAE were then being worked out in detail by the late Dr. E. W. Ferguson, the THEREVIDAE have been recently studied by Mr. J. Mann, and I was myself engaged on the ASILIDAE. The family here dealt with is the last of the series that has not hitherto come under a comprehensive review.

This paper on the EMPIDIDAE is treated on a wider basis than the others so as to take advantage of Collin's work on New Zealand forms, for many of the genera are common to the two areas and probably more of them are yet to be discovered.

*Classification.*—The classification of the EMPIDIDAE needs revision; some subfamilies form natural groups but too much stress is placed on venation, and other characters used are equally inefficient for the grouping of their components. Many genera need more adequate definitions, for these grade intimately towards each other; also, though standing contrasted on characters given, some are recognised on structures that seem to be hardly generic in importance. In this catalogue the standard treatment is given to the family and only a few minor changes are incorporated.

*Distribution.*

During 1922, in this journal (ii, p. 143-7), I drew attention to the fact that records of distribution for the 150 then known genera of TABANOIDEA, ASILOIDEA and EMPIDOIDEA occurring in Australia, yielded over 28 per cent. in common with South America, whereas under 27 per cent. (maximum) were common to islands north of Australia; these figures excluded 21 per cent., representing those having a cosmopolitan distribution. The conclusion I drew was based on these figures which are recognised as imperfect; nevertheless the evidence showed that Australia has a strong zoological affinity with South America in regard to the superfamilies dealt with, and it conformed to similar evidence in other branches of zoology.

I have seen but one published reference to that paper, a criticism that is brief and unsupported by data and therefore worthless as a contribution to the subject. New data is accruing and the affinity with South America is becoming more marked, and this is very apparent in the EMPIDIDAE; the data is shown below. It is pertinent to remark that recent researches tend to strengthen this position in the TABANOIDEA, but to weaken it in the ASILOIDEA.

Although I am not impressed by the manner in which genera are founded under modern systems of classification, and, although many workers are bringing about alterations in this respect, nevertheless I do not expect the broader views on the zoological distribution will break down under new treatment, but rather will stabilise the idea concerning the continental affinities. Already *Pelecorrhynchus* and *Chiromysa*\* have been divided by Enderlein to contain genera that are confined to one or other of the two continents, but in these cases an investigation of the views propagated have

\*Genera of the TABANIDAE and STRATIOMYIIDAE respectively. It will be remembered that Enderlein also split genera of the CHIROMYZINI into several tribes, thus the relationships became obscured (see Hardy, Proc. Linn. Soc. N.S.W., xlix., 1925, 360). Other equally outstanding examples are *Dasyomma* (LEPTIDAE) and *Ceratomerus* (EMPIDIDAE).



shown them to be based on a wrong surmise. Doubtless other attempts will be made to separate similarly distributed genera, and even if successful the scheme will not necessarily break down views concerning their affinities. One needs to approach such subjects with caution, and criticisms, other than of a constructive nature, are unwarranted.

In regard to EMPIDIDAE, in my original list I included several genera not recorded from Australia prior to that date (1922), and none of the 15 genera were shown to be in common with South America, other than cosmopolitan ones. The position has now changed, for there are three genera in the list below that are shown to be limited to Australia, New Zealand and South America, and of these *Ceratomerus* is a striking example, for such a distinctive form would hardly have been overlooked if it occurred elsewhere. Four genera are listed as being confined to New Zealand and South America. Contrasted with Africa, one finds that that continent has no known genera in common with Australia other than cosmopolitan ones and those limited to the extreme north, within the palaearctic zone. As in the previous list there are a number of gaps showing throughout the islands north of Australia, and doubtless some of these will be filled in time. I suspect, however, certain genera like *Leptopeza* may be found not to occur in Australia, and species standing under such generic names will be removed to more appropriate positions.

Generic relationships need a critical investigation, especially where the query mark (?) is given. Possibly *Leptopeza* does not occur in the Southern Hemisphere and all such located species should be referred to *Scelolabes*.

(See table opposite.)

#### Key to subfamilies of EMPIDIDAE.

1. Hind femora and tibiae very elongate, much longer than the others, which character, together with the eyes being contiguous on both sexes, immediately identifies the section. Vein R4 absent, otherwise the venation is variable; the cubital cell may be strongly formed, Cu1 being bowed outwards and meeting the anal at less than a right angle (*Hybos*), the cell thus formed being as long as or longer than the basal cells. The cubital cell may be shorter than the basal cells, in which case Cu1 is weak, straight and recurrent. . . . . HYBOTINAE.  
Without such combined characters. . . . . 2.
2. All veins enclosing the cubital cell strongly developed, that at its apex (Cu1) being strongly bowed outwards and meeting the anal cell at less than a right angle, thus making this cell as long as or longer than the basal cells. Vein R4 present. . . . . HOMALOCNEMINAE.  
Cubital cell not so formed, usually shorter than basal cells, but if as long the vein Cu1 meets the anal at more than a right angle. . . . . 3.
3. Anterior coxae very elongate, twice or more the length of the others. . . . . 6.  
Anterior coxae normal, not or not much longer than the others. . . . . 4.
4. Vein enclosing cubital cell strongly developed and usually bowed and strongly recurrent, forming with the anal vein an angle very much greater than a right angle. Median vein with usually three branches, rarely reduced in which case the strongly recurrent cubital vein will distinguish this section. . . . . 5.  
Vein enclosing cubital cell usually weak, often missing, but if present that at its apex (Cu1) is usually straight, meeting the anal at right angles or is recurrent, never bowed. Median vein rarely with more than two branches. . . . . 7.



Genera.	North America.	South America.	New Zealand	Australia	Malay and Polynesian Islands (ex. N.Z.).	Asia.	Europe.	Africa.
<i>Hybos</i> .. . . .	*	*		*	*	*	*	*
<i>Homalocnemus</i> .. . . .		*	*					
<i>Oreogeton</i> .. . . .	*	*	*					
<i>Empis</i> .. . . .	*	*	*	*	*	*	*	*
<i>Empidadelpha</i> .. . . .			*					
<i>Atrichopleura</i> .. . . .		*	?					
<i>Apalocnemis</i> .. . . .		*	?					
<i>Hilara</i> .. . . .	*		*	*				*
<i>Hilarempis</i> .. . . .		*	*	*			*	?
<i>Gynatoma</i> .. . . .			*					
<i>Dipsomyia</i> .. . . .		*	*					
<i>Tenotomyia</i> .. . . .				*				
<i>Dolichocephala</i> .. . . .				*			*	
<i>Chelipoda</i> .. . . .	*		*	*			*	
<i>Ptilophyllodromia</i> .. . . .				*				
<i>Monodromia</i> .. . . .			*	*				
<i>Phyllodromia</i> .. . . .			*				*	
<i>Dolidromia</i> .. . . .			*				*	
<i>Hemerodromia</i> .. . . .	*		*				*	
<i>Chelifera</i> .. . . .	*		*	*				
<i>Neoplasta</i> .. . . .	*		*	*				
<i>Cladodromia</i> .. . . .		*	*	*				
<i>Sematopoda</i> .. . . .			*	?				
<i>Ceratomerus</i> .. . . .		*	*	*				
<i>Iasma</i> .. . . .			*	*				
<i>Oropezella</i> .. . . .			*	*			*	
<i>Scelolabes</i> .. . . .		*	*	*				
<i>Leptozeza</i> .. . . .	*		?	?		*		
<i>Tachydromia</i> .. . . .	*	*	*	*	*	*	*	*
<i>Isodrapetis</i> .. . . .			*					
<i>Cheriodromia</i> .. . . .	*			*			*	*
<i>Halsanoletes</i> .. . . .				*				*
<i>Drapetis</i> .. . . .	*	*		*	*	*	*	
<i>Elaphropeza</i> .. . . .				*	*	*		

5. Empodium pulvilliform. . . . . CLINOCERINAE.  
Empodium not pulvilliform. . . . . EMPIDINAE.
6. Antennae short, normal. . . . . HEMERODROMIINAE.  
Antennae excessively large. . . . . CERATOMERINAE.
7. Median cell present. . . . . OCYDROMIINAE.  
Median cell absent. . . . . TACHYDROMIINAE.

#### Subfamily HYBOTINAE.

White placed two genera in this position, but one of these, *Ironomyia* White, belongs to the PLATYPEZIDAE; the other, *Sciadocera* White, belongs to the PHORIDAE; White considered that they probably belonged to this family, but he was not familiar with the PLATYPEZIDAE, otherwise he would have certainly placed the first genus there. *Hybos* is the only genus re-

corded from Australia, but there is another which, although coming somewhat near *Bicellaria*, cannot be placed there as it differs in several important characters; two are from Tasmania (Dunalley and Strahan, February, 1918, and 1924 respectively); and one specimen from Queensland (Brisbane, June, 1928).

#### Genus *HYBOS* Meigen.

Meigen, Illig. Magaz. Ins., ii., 1803, 269.

The members of this genus dance and hover in the air, sometimes singly, sometimes in numbers, and are to be found so doing during most months of the year around Brisbane, and during the summer months around more southern cities. When plentiful they are to be noted in gardens, on roadways, and in the bush, and I have them from Brisbane, Sydney, Melbourne, Launceston and Hobart, but their separation into species is not easy. There are evidently several species before me, but all conform best to *H. sydneyensis* in Bezzi's key, but one giant species from Cradle Mountain, Tasmania, is distinctively different, having its thorax and legs red.

#### Key to species of *Hybos* (adapted from Bezzi).

1. Wings with an elongate stigmatic spot black-brown; halteres white and more or less infuscated. . . . . 2.  
Wings with stigmatic spot short, halteres black. . . *brachystigma* Bezzi.
2. Thorax dorsally white grizzly; male genitalia bare. . . *pollinosus* Bezzi.  
Thorax dorsally never grizzly; male genitalia with setae. . . . .  
. . . . . *sydneyensis* Schiner.

#### *HYBOS SYDNEYENSIS* Schiner.

Schiner, Novara Reissa Dipt., 1868, 203.—Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 327.

#### *HYBOS POLLINOSUS* Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 327.

#### *HYBOS BRACHYSTIGMA* Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 327.

#### Subfamily EMPIDINAE.

The Australian forms placed in this section seem to be a homogeneous group of which there are but two satisfactory divisions; *Empis* and *Hilara-Hilarempis* complex. The method used in subdividing the second section is not satisfactory, for it is often difficult to separate *Hilarempis* from *Hilara*, and after allowing for these there is a residue left to some forms of which any of the three names, *Apalocnemis*, *Atrichopleura* and less probably *Antheopiscopus* may be applicable. *Rhamphomyia*, as used by White, would not seem to apply, because that genus has the so-called metapleura hairy or bristly, a character I have not noticed on any of the specimens before me. In this residue the venation is variable, R4 may be present or absent, and usually there are three branches to the media. One species, represented by four females from Western Tasmania, has the median cell exceptionally large, for it reaches nearly to the wing border, and it has but one vein issuing from its upper side, and sometimes a second one is at the extreme apex. Another species has the median cell missing. I have not detected amongst the group the New Zealand genera *Oreogeton* and *Gynatoma*, and the nearest I have seen to *Empidadelpha* has a short stump of a veinlet issuing from the extreme apex of the cubital cell (i.e., from Cu1), but the chief difference lies in the bare veins and in the absence of metapleural hairs, thus prohibiting its inclusion in that genus. A male from Sydney has a character that is probably a sexual one and is not un-

like those of some exotic DOLICHOPODIDAE; a triangular appendage occurs on the base of the anterior tarsi.

*Key to genera of the EMPIDINAE.*

1. Upper side of subcostal and sometimes cubital, and the lower side of the radial veins are bristly; metapleura bristly. . . . . *Oreogeton* Schiner.  
All veins bare. . . . . 2.
2. Metapleura bristly. . . . . 3.  
Metapleura bare. . . . . 4.
3. Subcostal vein long, running into the stigma at its apex. Median cell short and broad. Vein Cu1 bowed. . . . . *Empis* Lin.  
Subcostal vein short, not running into a stigma and ending at costa before the middle of the wing. Cu1 strongly bent outwards before becoming recurrent, thus making it somewhat S-shaped. . . . .  
 . . . . . *Empidadelpha* Collin.
4. Vein R4 absent. . . . . *Atrichopleura* Bezzi.  
Vein R4 present. . . . . 5.
5. Subcostal vein not running into a stigma. . . . . *Apalocnemis* Philippi.  
Subcostal vein running into a stigma. . . . . 6.
6. Mediastinal vein ending at costa. . . . . *Hilara* Meigen.  
Mediastinal vein fading away before reaching costa. . . . . 7.
7. Eyes of male separated on frons. Tip of abdomen on female pointed and ending in a pair of lamellae. . . . . *Hilarempis* Bezzi.  
Eyes of male contiguous. Tip of abdomen on female truncate, lamellae short and broad, and more or less concealed. . . . . *Gynatoma* Collin.

*Genus EMPIS Linnaeus.*

Linnaeus, Syst. Nat. Edit., x., 1758, 603.—White, Proc. Roy. Soc. Tasmania, 1916, 231.

White states that none of the species of this genus skim over the water like those of *Hilara* and allies, and, although this observation would appear to be quite correct in this way, the remark cannot be reversed in so far as I have a very outstanding species often taken at flowers, never on water, and yet has all the characteristics of *Hilara*, even to the swollen metatarsus of the male. Probably there is a complex in *Empis*, as well as in the *Hilara* group, and somewhere divisions are yet to be found that will give a more natural classification. Of the genus I have many species, some taken on the swamps of Cradle Mountain, Tasmania, that are remarkably outstanding in specific characters. Of those described, only four species can be placed here with any assurance.

*EMPIS BELLATORIUS* White.

White, Proc. Roy. Soc. Tasmania, 1916, 232.

*EMPIS SERICATUS* White.

White, Proc. Roy. Soc. Tasmania, 1916, 233.

*EMPIS AQUILUS* White.

White, Proc. Roy. Soc. Tasmania, 1916, 234.

*EMPIS FLABILIS* White.

White, Proc. Roy. Soc. Tasmania, 1916, 235.

*Genus HILARA* Meigen.

Meigen, System. Beschreib., iii., 1822, 1.—White, Proc. Roy. Soc. Tasmania, 1916, 220.

The species that come within this and the next genus are legion, ranging from some of the largest forms to a very small size, and nearly all have the habit of skimming over the surface of water. The character upon which the two genera are separated, namely, the complete or incomplete

subcostal vein, does not seem sound, for there are species that are difficult to adjust, the vein being almost and quite complete on the one species and there are graduations on others that lead to this state of affairs. I have been able to recognise two of Walker's species, to which two names given by White fall as synonyms.

HILARA CERTA Walker.

*Hilara certa* Walker, Ins. Saund. Dipt., i., 1852, 204.—*Hilara efficiens* White, Proc. Roy. Soc. Tasmania, 1916, 222.

HILARA CONFIRMATA Walker.

*Hilara confirmata* Walker, Ins. Saund. Dipt., i., 1852, 205.—*Hilara nimia* White, Proc. Roy. Soc. Tasmania, 1916, 223.

HILARA BALNEARIA White.

White, Proc. Roy. Soc. Tasmania, 1916, 223.

HILARA NUBILA White.

White, Proc. Roy. Soc. Tasmania, 1916, 234.

HILARA MOLLICELLA White.

White, Proc. Roy. Soc. Tasmania, 1916, 235.

*Species erroneously recorded as Australian.*

*Hilara litorea* Fali.—Walker, Ins. Saund. Dipt., 1852, 204.

This European species recorded, but not described, from Van Diemen's Land, is evidently an erroneous record.

Genus HILAREMPIS Bezzi.

*Hilarempis* Bezzi, Ann. Mus. Nat. Hungary, iii., 1905, 443.

*Hilaropus* White, Proc. Roy. Soc. Tasmania, 1916, 226.

Both Bezzi and White proposed separating this group from typical *Hilara* on the short subcostal vein so that there can be no doubt concerning this synonymy, for they must be regarded as but one genus until such times as it is possible to give a better system of making divisions.

It is interesting to note how these names were not associated by White himself. Bezzi has the group as allied to *Empis* from which he subsequently divided it, whereas White had it as a *Hilara* on account of its habits and so divided it from that genus.

HILAREMPIS HILARAEFORMIS Bezzi.

*Empis hilaraeformis* Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 340.

*Hilarempis hilaraeformis* Bezzi, *ibidem.*, iii., 1905, 443.

HILAREMPIS CYANESCENS Bezzi.

*Empis cyanescens* Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 342.

*Hilarempis cyanescens* Bezzi, *ibidem.*, iii., 1905, 443.

HILAREMPIS PALLIDIFURCA White.

*Hilaropus pallidifurca* White, Proc. Roy. Soc. Tasmania, 1916, 227.

HILAREMPIS NIGRIMANUS White.

*Hilaropus nigrimanus* White, Proc. Roy. Soc. Tasmania, 1916, 228.

HILAREMPIS PEREGRINUS White.

*Hilaropus peregrinus* White, Proc. Roy. Soc. Tasmania, 1916, 228.

HILAREMPIS ECHINATUS White.

*Hilaropus echinatus* White, Proc. Roy. Soc. Tasmania, 1916, 230.

*Species of uncertain generic position.*

*Empis brevirostris* Macquart, Dipt. Exot., suppl. 4, 1849, 96.—Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 343, nota 3.—White, Proc. Roy. Soc. Tasmania, 1916, 232. (Described from Tasmania, but probably was from Sydney).



*Empis xanthopyga* Schiner, Novara Reisa Dipt., 1868, 204.—Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 343, nota 3.

*Empis tenuirostris* Thomson, Eugenies Resa, Dipt., 1869, 473.—Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 341, nota 2.

*Empis pachypodiata* Bigot, Ann. Soc. Ent. France (6), ix., 1889, 132.—Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 343, nota 1.

*Antheopiscopus antipoides* Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 339.—The species does not conform very well with the genotype.

*Rhamphomyia aprilis* White, Proc. Roy. Soc. Tasmania, 1916, 238.

*Rhamphomyia septembris* White, Proc. Roy. Soc. Tasmania, 1916, 239.—

No specimens before me conform to the genus *Ramphomyia*, although many seem to have the appearance of it.

*Microphorus hiemalis* White, Proc. Roy. Soc. Tasmania, 1916, 240.—White was doubtful about the subfamily status, but I have specimens undoubtedly conspecific, and these are *Empidinae* in affinities, not *Ocydromyinae* where White placed his specimens.

#### Subfamily HEMERODROMIINAE.

All genera that have the anterior coxae elongate, combined with normal size antennae, are placed in this subfamily. I do not think it is quite a natural formation as *Tenotomyia*, at least, is aberrant in many characters. The more typical genera have their anterior legs raptorial, and all of them show a wide divergence in venation, so that most of the characters found in other subfamilies are paralleled in this group.

Specimens conforming to most of the genera listed are before me, those missing being *Doliodromia*, *Phyllodromia* and *Hemerodromia*. Care had to be taken in interpreting some of the genera; the names of two, *Phyllodromia* and *Chelipoda*, were interchanged so that authors have been using these in a different sense; in this catalogue the interpretations follow that given by Collin.

#### Key to genera of the HEMERODROMIINAE.

1. Wings with an interrarial cross-vein; anterior legs simple. . . . . 2.  
Wings without an interrarial cross-vein; anterior legs strongly raptorial in many cases. . . . . 3.
2. Vein R4 absent; Cul strongly recurrent, as in *Empis*; wings hyaline. . . . . *Tenotomyia* White.  
Vein R4 present; wings mottled, some veins sinuous. . . . . *Dolichocephala* Macquart.
3. With vein R4 absent. . . . . 4.  
With vein R4 present. . . . . 8.
4. Median cell incomplete. . . . . 5.  
Median cell complete, at most the cross-vein separating it from the basal cell is absent. . . . . 7.
5. Vein M3 absent or vestigial. . . . . *Monodromia* Collin.  
Vein M3 present. . . . . 6.
6. Vein M3 branching from M4. . . . . *Doliodromia* Collin.  
Vein M3 branching from M1 + 2. . . . . *Phyllodromia* Zett.
7. The arista-like projection of antennae without long hairs, pubescent only. . . . . *Chelipoda* Macquart.  
The arista-like projection of antennae with hair below of medium length or very long. . . . . *Ptilophyllodromia* Bezzi.
8. Median cell incomplete. . . . . *Hemerodromia* Meigen.  
Median cell complete, at most only the basal cross-vein is missing. . . . . 9.
9. Vein M3 coincident with vein M1 + 2 for a long distance before branching. . . . . *Chelifera* Macquart.

- Vein M3 arising independently from the median cell or at most branching from M1 + 2 very near the cell. . . . . 10.
10. Median cell confluent with the basi-median cell. . . . .  
     Median cell separated from the basi-median cell by a cross-vein. . . . . 11. *Neoplasta* Coquillett.
11. Anterior legs strongly raptorial. . . . . *Cladodromia* Bezzi.  
     Anterior legs not raptorial. . . . . *Sematopoda* Collin.

Genus *TENONTOMYIA* White.

White, Proc. Roy. Soc. Tasmania, 1916, 236.

This genus contains one quite distinctive species widely distributed over Tasmania, and also found in Victoria, New South Wales and the National Park, Queensland. Its slender long abdomen and legs and narrow wings remind one somewhat of the Tipulidae. The cross-vein between the branches of the radial may be regarded as the vein R4, but I do not think that view will prove correct if judged in accordance with Tillyard's interpretation.

*TENONTOMYIA GRACILIPES* White.

White, Proc. Roy. Soc. Tasmania, 1916, 237.

Genus *DOLICHOCEPHALA* Macquart.

Macquart, Mem. Soc. Sci. Lille., 1823, 147.

One specimen before me, taken on a window of the Springs Hotel, Mount Wellington, Tasmania, January, 1924, agrees in generic characters with European species, including pictured wings.

Genus *MONODROMIA* Collin.

Collin, New Zeal. Dipt., 1928, 24.

A species in Australia runs to this genus, but all the characters given do not apply.

Genus *CHELIPODA* Macquart.

*Chelipoda* Macquart, Mem. Soc. Sci. Lille., 1823, 148.

*Hemerodromia* Hardy, Austr. Zool., ii., 1922, 147.

One Tasmanian form has a short second radial vein ending round a large dark disc and the vein dividing the median and the basi-median cells is missing; two specimens from Strahan, February, 1924. Another species is quite normal, whilst the third has the intermediate femora swollen and with a row of long bristles, comb-like, on the anterior side. In all four species are before me.

Genus *PTILOPHYLLODROMIA* Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 344.

Only to be distinguished from *Chelipoda* by the long hairs on the underside of the long antennal style. One Tasmanian species is before me and I have seen four others from Victoria in Mr. E. Wilson's collection. A specimen from Blackheath has the antennal hairs short so would be an intermediate form that suggests the generic status may not be warranted.

*PTILOPHYLLODROMIA EIROI* Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 345.

Genus *CHEILIFERA* Macquart.

Macquart, Mem. Soc. Sci. Lille., 1823, 150.

Two specimens before me, one from Blackheath, the other from Strahan, are both without the vein dividing the median and basi-median cells.

## Genus NEOPLASTA Coquillett.

Coquillett, Proc. U.S. Nat. Mus., xviii., 1895, 392.

A single specimen from Brisbane runs to this genus according to key characters; it has a very short strongly up-curved second radial vein which runs into the basal section of the stigma; the latter is elongate and hardly noticeable. Other characters agree with Melander's figure (Williston, North American Diptera, 3rd edit., 1908, p. 221). The anterior femora are slender but provided with two rows of long thin hook-shaped bristles, whilst a line of similar ones occur on the tibiae, and the complete set appears to be intended for entrapping prey.

## Genus CLADODROMIA Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, iii., 1905, 453.

This is a South American genus to which Collin added four species from New Zealand. Two species from Tasmania conform to it.

## Genus SEMATOPODA Collin.

Collin, New Zeal. Empid., 1928, 51.

This genus was based on a unique male and according to its key characters two Tasmanian species come within it, but both have a much longer cubital cell. One has the apical vein Cu1 strongly recurrent as in genus *Empis*, and in addition the anterior metatarsus is swollen, but I have compared it with two similar looking species from the same locality, both undoubted *Empidinae*, and have concluded the unique male before me is decidedly related to the *Hemeromiinae*.

## Subfamily CERATOMERINAE.

Many of the structures on species of this subfamily are reminiscent of *Hemeromiinae*, but the group differs in the antennae which are excessively large. It is not uncommon in Tasmania, but appears to be very local, occurring in favoured spots which need to be searched for. There are two genera defined, and one, *Icasma* Collin, may be distinguished by the absence of vein R4.

## Genus CERATOMERUS Philippi.

Philippi, Verh. zool. bot. Ges. Wien., xv., 1865, 765.—Bezzi, Ann. Mus. Nat. Hungary, iii., 1905, 458.—Collin, New Zeal. Empid., 1928, 16.

This is the only genus recognised in Australia and of it four species are before me from Tasmania. All have the same general appearance, but they differ widely in specific characters. One specimen has an interradiar cross-vein on one wing only.

Key to species of *Ceratomerus*.

1. Radial vein more or less straight, only bending towards costa at apex. . . . . 2.  
 Radial vein abruptly deviating away from costa near stigma beyond which it returns to meet costa. Third antennal segment broad at base. Legs normal. . . . . *inflexus* n.sp.
2. Stigma present, venation normal. Third antennal segment rather slender at base. . . . . 3.  
 Stigma absent, venation symmetrical in the bifurcation and length of the median and certain radial veins. Third antennal segment broad at base, legs normal. . . . . *ordinarius* n.sp.
3. Intermediate femora with a tubercle below and also a large cavity; intermediate tibiae with a set of tubercles. Antennae unicolorous, brown. . . . . *tuberculus* n.sp.  
 Intermediate femora and tibiae normal, without tubercles. Antennae white at the apex. . . . . *albistilus* n.sp.

*CERATOMERUS ALBISTILUS* n.sp.

The typical venation and more or less slender antennae with a white apex, will readily distinguish this species which is comparable with Collin's illustration.

Head black-brown, frons wide, dull, the dull area surrounds the ocellar tubercle and behind this the head is shining. The frons tapers towards the antennae at the base of which there is an acute triangular indentation of the eye margin, and from thence the eye margin runs more or less parallel down the face (the head has collapsed somewhere on every specimen before me and in no case is the character of the face to be made out with assurance). The ocellar tubercle contains two long bristles and behind these there is a row equivalent to the postoculars, and about three pairs of bristles lie in a row between the summit and the neck.

The antennae contain a long first segment with many bristles and the second has a short basal part equal to the first in width, but is attenuated into a long process to which the third segment is attached on the outer side; a crown of rather long bristles occurs on the basal part. The third segment, having a process of the second showing on its inner side, is a little wider than the basal segments for about a third its length, then tapers for another third and terminates in a white apical third which is black at the base; the intermediate third is also black, but the broadest third is brown. The palpi are small and black, the proboscis brown.

Thorax black-brown, a whitish line may be detected down the dorsum and this may be divided longitudinally where the acristical bristles occur. The prothorax, the humeral callus and an area at insertions of the wings, may be more or less yellowish. One pair each of long bristles represent the prothoracic, humeral, presutural dorsocentral, presutural (?), notopleural, supra-alar and scutellar bristles; in addition there are one long and one short postsutural dorsocentrals, one short postalar bristle and a few short dorsocentrals placed anteriorly to the long one detected, and some similar ones are to be seen elsewhere on the dorsum, usually in small groups.

The abdomen is seven segmented, black, but with yellow margins at apex of segments which bear short black bristles. The ovipositor is not detected.

Halteres and legs yellow, the latter are simple, except on the anterior and posterior tibiae there is a small plate-like process at the apex, on the inner side, and may readily be overlooked; the character is common to all forms.

The wings have a simple venation. The costa continues round the wing as a circumambient vein and near its base there is one outstanding long bristle. The subcosta runs into the costa at a point parallel with the apex of the basi-radial cell. The vein R1 runs into the costa as far again from the wing base and beyond this there is a stigma to and around the apical margin of which the vein R2 + 3 runs without a deviation. Veins R4 and R5 are normal, as are the three median veins, the first two of which branch from each other at a normal distance from the median cell, long before reaching a point parallel to the bifurcation of the fourth and fifth radial veins. The median cell is long and slender, but the vein at the base becomes weak so that it is nearly broken down, thus making the cell almost confluent with the basi-median which is only half the length of the basi-radial cell. The cubital vein, like most of the anal vein, is almost obliterated, but their remains form an acute angle with each other and the cubital cell thus traced is as long as the basi-median. The anal area of the wing is strongly reduced.

*Hab.*: Tasmania, Mount Wellington, January, 1917 and 1924, 2 females; Strahan, February, 1924, 14 females; Cradle Mountain, January, 1917, 1 female.



*CERATOMERUS TUBERCULUS* n.sp.

Very like the preceding species but the antennae are unicolorous and the intermediate legs have some tubercles; it is apparently not the male of *C. albistilus*. Characters not mentioned below are the same as those of the prior species.

The antennae have the third segment uniformly dark brown and the palpi are not discernible. The abdomen is black and has seven segments which are hardly lighter at their apex. An eighth sternite is conspicuous and supports the large complex hypopygium which overlies the seventh tergite. The anterior and posterior legs are simple except for the small apical plate, but the intermediate legs are provided with a set of tubercles and some bristles, the latter being placed in an orderly arrangement that suggests they are in some way connected with the utility of the tubercles. Towards the apex of the intermediate femora, on the underside, there is a large cavity bounded by a tubercle at the base and a short blunt spine at the apex. When the tibiae are retracted, it is seen that this indentation corresponds to some tubercles on the underside of the tibiae. There is one large spur-like tubercle, diverted anteriorly, and two much smaller ones; the spine at the apex of one of the smaller ones is strongly bent at its base. A little beyond these is another tubercle, and, again, on the anterior side of the tibiae, towards the apex, there is yet another tubercle arranged like a flange.

*Hab.*: Tasmania, Mount Wellington, 1 male, 5th January, 1919. This was probably taken above 3,000 ft.

*CERATOMERUS INFLEXUS* n.sp.

A species readily recognised by the vein  $R2 + 3$  which takes a sudden deviation to surround the stigma, and by the third antennal segment being very broad at the base. Characters not mentioned below are as on the prior species.

The head is black-brown and the brown antennae are of the same general structure as the others, but the third segment is very much broader at its base to about one-third its length, sharply tapers for another third, and thence gradually tapers to the apex. The thorax is black-brown and in both sexes there are two pair of presutural dorsocentral bristles; on the male the acrostichals are not discernible; this is a character that seems consistent on this sex in all species. Hypopygium rather small. The legs are simple, except the anterior and posterior femora have the usual small apical projection.

The wings have the subcosta reaching a little beyond the point parallel with the base of the median cell. The vein  $R2 + 3$  lies rather close to the costa, but makes a wide detour round the stigma before running into it. The vein dividing the basal cells is almost obliterated, as also are the cubital and anal.

*Hab.*: Tasmania, Mount Nelson (Hobart), 27th December, 1917; one male and two females.

*CERATOMERUS ORDINATUS* n.sp.

Very distinctive in being without a stigma and also in the arrangement of the venation, otherwise rather like *C. inflexus*, with which it agrees in all characters not mentioned below.

Antennae, legs and chaetotaxy as in *C. inflexus*. Hypopygium very large. The second radial vein runs normally and without a deviation other than the gentle apical curve; stigma absent. The two first median veins do not branch away from each other till they reach a position parallel with the bifurcation of  $R4$  and  $R5$ . The median cell is complete at its base, but that vein dividing the basal cells is obliterated, as also are the cubital and

anal veins. In the form of the median and basal cells this species is like Collin's illustration of *Icasma*, but the first median lies almost parallel with the fifth radial, and the apex of the third and second median reach as far from the base of the wing as do the veins R2 + 3 and R4 respectively, thus the symmetry of the venation becomes an outstanding feature.

*Hab.*: Tasmania, Strahan, 1 male, February, 1924; taken in company with *C. albistylus*.

#### Subfamily OCHYDROMIINAE.

The Australian forms have only two complete veins issuing from the median cell; the third is sometimes present but stunted. It is possible that *Anthepiscopus antipodus* Bezzi, may belong here, as one of its median veins fails to reach the wing margin, but the genus *Anthepiscopus* Becker, is regarded as being an *Empidinae*.

#### Key to genera of the OCHYDROMIINAE.

1. Antennae placed very high on head, much above the middle, so that the frons is very short, the face very long. Anal area of wings much reduced. . . . . *Oropezella* Collin.  
Antennae normally placed so that the face and frons are about equal in length. Anal area of wing very well developed. . . . . 2.
2. Hind femora stout and strongly spinose below. . . . *Scelolabes* Philippi.  
Hind femora slender and not spinose below. . . . *Leptopeza* Macquart.

#### Genus OROPEZELLA Collin.

Collin, Ent. Mo. Mag., lxii., 1926, 214; and New Zeal. Empid., 1928, 9.

This genus is represented by a small series from the National Park, Queensland, March, 1921, and another series from Strahan, Tasmania, February, 1924.

#### Genus SCELOLABES Philippi.

Philippi, Verh. zool. bot. Ges. Wien., xv., 1865, 751.—Collin, New Zeal. Empid., 1928, 15.

There are in the Commonwealth several species that might well come within this genus, having the characters as given by Collin, but their separation from those otherwise left in the genus *Leptopeza* scarcely seems warranted. One specimen from Melbourne conforms here, as also does *Leptopeza rubrithorax*, and probably others described by White. I would suggest that all Australian and New Zealand species of *Leptopeza* should be placed here, and *Leptopeza* (*sensu stricto*) would be retained for species of the Northern Hemisphere, the difference in the length of the cubital cell, if consistent, might serve for a temporary distinguishing character.

#### Genus LEPTOPEZA Macquart.

Macquart, Suit. a Buffon, i., 1834, 320.—White, Proc. Roy. Soc. Tasmania, 1916, 241.

White recognised from Tasmania two species of this genus recorded by Bezzi from New South Wales, but it is not certain if White's species is truly identical. Probably there is a complex in the genus of which ten or more species are before me. All have the cubital cell half the length of the basimedial, whereas the typical form has these two cells of almost equal length.

#### LEPTOPEZA PULCHERRIMA Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 336.—White, Proc. Roy. Soc. Tasmania, 1916, 243.

New South Wales: five specimens from Sydney and Blackheath, September and November, 1917, 1919 and 1921; Tasmania: six specimens from Hobart and Mount Wellington, September to January, 1915, 1917 and 1924.

## LEPTOPEZA BIMACULATA Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 337.—White, Proc. Roy. Soc. Tasmania, 1916, 242.

Tasmania: Eighteen specimens from Hobart, Mount Wellington and Strahan, September to April, 1915, 1918, 1924.

## LEPTOPEZA TACHYDROMIAEFORMIS Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 338.

## LEPTOPEZA RUBRITHORAX White.

White, Proc. Roy. Soc. Tasmania, 1916, 243.

Tasmania: Ten specimens from Hobart and Mount Wellington, September to January, 1916, 1917 and 1924.

## LEPTOPEZA LEVICOSTA White.

White, Proc. Roy. Soc. Tasmania, 1916, 244.

## LEPTOPEZA SERRATICOSTATA White.

White, Proc. Roy. Soc. Tasmania, 1916, 245.

Tasmania: Seventeen specimens from Hobart, Mount Wellington, Wedge Bay, Launceston, September to December, 1916-1918; another from Brown's River, April, 1917, may represent an allied species.

## Subfamily TACHYDROMIINAE.

## Key to genera of TACHYDROMIINAE.

1. Cubital cell distinct. Intermediate femora incrassate. . . . . *Tachydromia* Meigen.  
Cubital cell absent. . . . . 2.
2. Basi-radial cell not, or but little shorter than the basi-medial. . . . . 3.  
Basi-radial cell very much shorter than the basi-medial; about half its length. . . . . 5.
3. Legs without bristles. Basi-radial cell slightly shorter than basi-medial. . . . . *Isodapetis* Collin.  
Legs with bristles. Basi-radial cell slightly longer than basi-medial. . . . . 4.
4. Antennae with apical seta. . . . . *Chersodromia* Walker.  
Antennae with dorsal seta. . . . . *Halsanalotes* Becker.
5. Third antennal segment short, scarcely longer than second. . . . . *Drapetis* Meigen.  
Third antennal segment distinctly longer than second. . . . . *Elaphropeza* Macquart.

## Genus TACHYDROMIA Meigen.

Meigen, Illig. Mag. Ins., ii., 1803, 269.

Eight specimens from Tasmania (Mount Wellington, December and January, 1916, 1917) conform to this genus.

## Genus CHERSODROMIA Walker.

Walker, Ins. Brit. Dipt., i., 1851, 137.

## CHERSODROMIA LUTESCENS Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 358.

Four specimens apparently congeneric with this species were taken on windows in Brisbane (October, 1922, 1925, and May, 1928), and they do not conform to the description sufficiently well to be regarded as conspecific with *C. lutescens*, which is from Sydney.

## Genus HALSANALOTES Becker.

Becker, Mitteil. Zool. Mus. Berlin, ii., 1902, 42.

## HALSANALOTES SETIFRONS Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 357.

## Genus DRAPETIS Meigen.

Meigen, System. Beschreib., iii., 1882, 91.—Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 350.

## DRAPETIS (CTENODRAPETIS) CILIATOCOSTA Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 355; and Wien. Ent. Zeit., xxiii., 144 (reference only).

Described from Brisbane where it is abundant and to be taken by sweeping grass; it occurs on windows throughout most of the year.

## Genus ELAPHROPEZA Macquart.

Macquart, Ins. Dipt. d. Nord France, iii., 1827, 86.

## ELAPHROPEZ BICOLOR Bezzi.

Bezzi, Ann. Mus. Nat. Hungary, ii., 1904, 357; and v., 1907, 567 (in key).

## FIVE NEW GENERIC NAMES FOR AUSTRALIAN FISHES.

By GILBERT P. WHITLEY,

Ichthyologist, Australian Museum.

(By permission of the Trustees of the Australian Museum.)

## Family OPHICHTHIIDAE.

ZONOPHICHTHUS, *gen. nov.*

Orthotype, *Ophichthys cephalozona* Bleeker (Atl. Ichth., iv., 1864, 45 & 49, pl. clvi., fig. 2. Amboina).

Tail slightly longer than head and body, but shorter than in *Muraena ophis* Linné, the tautotype of *Ophichthus* Thunberg, 1789, and *Ophisurus* Lacépède, 1800. Vomerine teeth in a single series; nasal teeth reaching beyond lower jaw; and a thorn-like caudal tip as in *Centrurophis* Kaup, 1856, but differs from that genus in having a large dark mark on crown of head, descending over sides before gills and strongly contrasting with a light area before and behind it. If, as Weber & Beaufort suggest, *Ophichthys cephalozona* Bleeker, 1864, is synonymous with *Muraenopsis marginatus* Bleeker, 1863, ex Valenciennes MS., then this species will be known as *Zonophichthus marginatus* Bleeker.

## Family HEMIRAMPHIDAE.

FARHIANS, *gen. nov.*

Orthotype, *Hemiramphus commersonii* Cuvier (Règne Anim., ed. 2, ii., April, 1829, 286, footnote 1. Based on Lacépède, Hist. Nat. Poiss., v., 1803, pl. vii., fig. 3. "Indies" = East Indies, type locality by present designation).

Triangular part of upper jaw broader than long. Teeth tricuspid. Dorsal fin originating before anal and with its base twice as long as that of anal. Ventrals inserted nearer caudal fin than head. Pectorals not so



long as head, excluding jaws. Body much deeper than wide, with less than sixty transverse series of scales, and with a series of large black spots on the sides. This species is generally known as *Hemiramphus far* (Forskaal), but the name *far* was only used in a vernacular sense, until 1837, when Rüppell latinized it, but *H. commersonii* Cuvier, has priority.

Family MUGILIDAE.

*ELLOCHELON*, *gen. nov.*

Orthotype, *Mugil vaigiensis* Quoy & Gaimard (Voy. Uranie & Physic., Zool., 1825, 337, pl. lix., fig. 2. Waigiou).

No adipose eyelid. Upper lip not thickened. Less than thirty transverse series of scales on body. Anal fin with eight rays. Pectorals blackish superiorly.

I may here remark that *Ello* Gistel (Handb. Naturges., "1850" = 1847, 356; Nat. Thierr., 1848, 109) is a synonym of *Mugil* Linné, 1758, which appears to have been overlooked.

Family APOGONIDAE.

*ASPISCIS*, *gen. nov.*

Orthotype, *Apogon savayensis* Günther (Proc. Zool. Soc. Lond., 1871, 656. Savay, Samoa).

Preoperculum serrated. Orbit and preorbital entire. Villiform teeth on jaws, vomer, and palatines; none on tongue. A flat opercular spine. Maxillary not reaching vertical of hinder margin of eye. A dark oblique streak from eye to preopercular angle. Scales large, ctenoid, in about twenty-five transverse series on body and in two rows between the first dorsal and the complete lateral line. Depth less than one-third standard length, slightly less than length of head. No subcutaneous peritoneal tube over anal. Seven smooth spines in first dorsal, which is separate from second. Vent immediately in advance of the short anal fin. Caudal incised.

Family LABRIDAE.

*DOTALABRUS*, *gen. nov.*

Orthotype, *Cheilinus aurantiacus* Castelnau (Proc. Zool. Acclim. Soc. Vict., i., July 15, 1872, 245. St. Vincent Gulf, South Australia).

This handsome South Australian Parrot Fish is easily distinguished from *Pseudolabrus* and *Cheilinus* by the rounded margin of the pectoral fin and the pencilled membranes of the anterior dorsal. The basal halves of the dorsal and anal fins are scaleless and there are less than four rows of scales on the cheeks. *Cheilinus aurantiacus* was more fully described by Castelnau in the second volume of the work cited above. *Labrichthys elegans* Steindachner (Sitzb. Akad. Wiss. Wien., lxxxviii., 1, 1884, 1102, pl. vi., figs. 2-3. St. Vincent Gulf) is a synonym of *Dotalabrus aurantiacus*.

THE AUSTRALIAN ANTS OF THE GENUS DOLICHODERUS  
(FORMICIDAE).

Subgenus HYPOCLINEA Mayr.

By J. CLARK, F.L.S.,

Entomologist to the National Museum of Victoria, Melbourne.

In the Genera Insectorum, 1912, Emery records seven species and one variety of this genus as occurring in Australia. Since that time one subspecies and two varieties have been added, making a total of eleven forms at present known.

It is now proposed to add eight new species and to make a slight revision of those previously described. I have not seen the species described as *Dolichoderus turneri* Forel, from Queensland, but have included a rather free translation of the original description for the sake of completeness.

*Hypoclinea flavipes* Kirby, was omitted by Emery from the Genera Insectorum. The short description given by Kirby for this species is misleading and useless. It has been dealt with at the end of the paper. Forel has redescribed this ant as *Iridomyrmex rostrinotus*. Kirby's name, however, must taken precedence.

So far as our Australian species are concerned this genus is badly defined. The characters given are suitable for the species of the group *scrobiculatus* Mayr, which resembles the European *Dolichoderus* (*Hypoclinea*) *quadripunctatus* Linn. In this group the thorax is not furnished with spines, but the posterior margin of the epinotum overhangs the declivity. In the group *scabridus* Roger, the epinotum does not overhang the declivity, but is furnished with two long spines, directed upward, outward and backward. In the group *doriae* Emery, both the epinotum and pronotum are furnished with spines. The node not spined.

The females of the *doriae* group are unknown. Forel has described the male of *doriae*; the description is, however, too imperfect to be of any use. In the *scabridus* group only the male is known. One female, but no male, is known in the *scrobiculatus* group.

For the use of Australian students, a brief generic description has been included. This deals with the workers only.

Very little is at present known concerning these ants. They are frequently met with on plants infested with Scale-insects and Frog-hoppers, being attracted to the exudations of these insects. The nests generally are crude. Usually they are represented by temporary structures at the foot of a small plant or shrub, or, more frequently, under loose bark on the ground; very rarely under logs or stones. In these situations the ants, usually, are found clustered in a large mass of from 100 to 200 specimens, scattering rapidly in all directions when disturbed. Although many such nests have been examined the female has not been seen, but males often are present, together with larvae and pupae.

The species of the *scrobiculatus* group are distributed widely throughout Australia, whilst the *scabridus* group is found mainly in Southern Australia. The *doriae* group is found in Queensland and New South Wales, one species ranging into Victoria.

Genus DOLICHODERUS Lund.

Ann. Sc. Nat., 23, p. 130, 1831; Forel, Bull. Soc. Vaud. Sc. Nat., 15, p. 386, 1878; Emery, Genera Insectorum, Fasc., 137, p. 7, 1912.

Subgenus HYPOCLINEA Mayr.

Emery, Genera Insectorum, Fasc., 137, p. 10, 1912; *Hypoclinea* Mayr., Verh. Zool-bot. Ver. Wien., 5, p. 377, 1855; Ver. Zool-bot. Ges. Wien., 12, p.

704, 1862; Jour. Mus. Godeffroy, 12, p. 79, 1876; Emery, Bull. Soc. Ent. Ital., 26, p. 234, 1894.

*Worker.* Monomorphic. Head convex above. Maxillary palpi six, the labial palpi four segmented. Antennae with twelve segments. Clypeus convex, indented in the middle. Thorax variable, usually without spines, but in some species the epinotum is spined; in others both the epinotum and pronotum are spined. Node scale-like, inclined forward, convex or concave above, never spined.

Males and females too little known to be defined.

The following table will assist in determining the species:—

1. Pronotum and epinotum furnished with spines. . . . . 6—9.
2. Epinotum only furnished with spines. . . . . 10—15.
3. Thorax not furnished with spines. . . . . 16—25.
4. Epinotum overhanging the declivity. . . . . 16—22.
5. Epinotum not, or very slightly overhanging the declivity. . . . . 23—25.
6. Black. Spines of the pronotum as long as those of the epinotum. Node thin, concave above. . . . . *tristis* n.sp.
7. Black. Legs and spines red. Spines of the pronotum almost as long as those of the epinotum. Node straight on top. . . . . *doriae* Emery.
8. Mandibles, antennae, spines and legs reddish. Spines of the pronotum slender, directed more outward and downward, one-third shorter than those of the epinotum. . . . . *dentata* Forel.
9. Spines of the pronotum projecting laterally at a right angle, directed slightly upward. Top of the epinotal declivity striate. . . . . *extensispinosa* Forel.
10. Legs red, tarsi and mandibles brown. Spines of the epinotum widely separated at the base. . . . . *scabridus* Roger.
11. As in *scabridus* Rog., but the antennae red. The spines more slender. . . . . var. *ruficornis* Sants.
12. Mandibles and legs red. Spines of the epinotum meeting at the base, slender and erect. . . . . *ypsilon* Forel.
13. As in *ypsilon* For., but entirely black, the spines longer and more slender. . . . . var. *nigra* Crawley.
14. As in *ypsilon* For., but the tibia, tarsi and anterior borders of the mandibles red. Spines short and thick. . . . . var. *rufotibialis* n.var.
15. Black. Head as long as broad. Spines of the epinotum long and slender, almost parallel. . . . . *angusticornis* n.sp.
16. Black. Mandibles and antennae reddish. Epinotal declivity finely transverse striate. Node thick, coarsely rugose. Pronotum flattened above. . . . . *scrobiculatus* Mayr.
17. Black. Mandibles, antennae and legs brown. Pronotum concave above in front. Node smooth and shining. . . . . *occidentalis* n.sp.
18. Red. Antennae, node and gaster black, mandibles and legs brown. Pronotum concave longitudinally in the middle. Node smooth. . . . . *nigricornis* n.sp.
19. As in *nigricornis* n.sp., but the head and antennae brown, legs reddish brown. Sculpture much finer. . . . . *formosus* n.sp.
20. Brownish red. Pronotum depressed above, smooth and shining. Epinotum only slightly overhanging the declivity. . . . . *clusor* Forel.
21. Red. Gaster yellowish red. Epinotum overhanging the declivity by fully half its length. Node thin. . . . . *reflexus* n.sp.
22. Brownish. Node thick, much broader than the epinotum. . . . . *turneri* Forel (1).
23. Head and gaster black, thorax red, legs brown. Finely reticulate and shining. Pronotum smooth, depressed in front. . . . . *australis* Andre.

24. Red. Gaster black, mandibles, antennae and legs yellow. Size small. . . . . *parvus* n.sp.  
 25. Black. Pronotum smooth and shining. Gaster densely pubescent. . . . . *goudiei* n.sp.

(1). From the description only.

*DOLICHODERUS* (HYPOCLINEA) *DORIAE* Emery.

Figs. 1 & 1a.

Ann. Mus. Nat. Civ. Stor. Genova, 24, p. 252, 1887, ♀; Forel, Rev. Suisse Zool., 10, p. 461, 1902, ♂; Genera Insect., 137, p. 12, 1912, ♀.

*Worker.* Length: 8-8.5 mm.

Black. Mandibles and antennae brown, legs and apex of the spines red.

Shining. Head and thorax irregularly rugose-punctate. Clypeus longitudinally rugose. Antennal fovea striate-reticulate. Node coarsely rugose. Gaster densely and microscopically punctate.

Hair yellow, erect, moderately long and abundant throughout, shorter and suberect on the antennae and legs. Pubescence very fine and adpressed on the antennae, long and abundant on the gaster, where it forms a dense yellowish clothing almost hiding the sculpture.

Head ovate, much broader behind than in front, broadest just behind the eyes, occipital border and sides strongly convex. Frontal carinae erect, diverging outward behind, separated by almost their length. Clypeus convex on top, the anterior border convex, with a slight excision at the middle. Eyes small, globular, placed at the middle of the sides. Scape of the antennae extending beyond the occipital border by fully one-third of their length; first segment of the funiculus slightly longer than the second, the others subequal. Mandibles armed with eleven teeth. Thorax fully twice as long as broad. Pronotum twice as broad as long, furnished with two long horizontal spines in front, directed forward and very slightly outward; they are as long as their distance apart at their base. Mesonotum circular, convex above, in profile dome shaped, raised well above the pronotum. Epinotum longer than broad, triangular, furnished with two long, sharp, almost straight, spines directed upward and backward, at an angle of forty-five degrees; in profile the dorsum is straight, the declivity forming a right angle, concave at the bottom. Node scale-like, three times broader than long, concave in front, convex behind; in profile the anterior face straight, the dorsum and posterior face united in a curve. Gaster longer than broad, the anterior border concave below. Legs long and slender.

*Hab.*: Victoria, Fernshaw (W. Kershaw); Bogong High Plains and Ferntree Gully (F. E. Wilson). New South Wales, Blue Mountains (E. W. Ferguson); Sydney (H. P. Schrader); Katoomba (W. W. Froggatt); Lismore (C. F. Deuquet); Wahroonga (H. J. Carter). Queensland, Toowoomba (W. B. Barnard); Tambourne Mountain (—————); Stanthorpe (H. J. Carter, E. Sutton).

The description given by Forel for the male of this species is inadequate. It may apply to any species. There is nothing to indicate that the example is a male.

*DOLICHODERUS* (HYPOCLINEA) *TRISTIS* n.sp.

Figs. 2 & 2a.

*Worker.* Length: 8-8.8 mm.

Black. Legs blackish brown.

Shining. Head coarsely punctate. Clypeus more finely and sparsely punctate. Pronotum with large shallow punctures. Pronotum with similar punctures in front, almost effaced behind. The constriction and



anterior half of the epinotum almost smooth, posterior half punctate like the pronotum. Top of the node finely and irregularly rugose. Gaster densely and microscopically punctate.

Hair yellow, suberect, short and rather sparse throughout. Pubescence apparent only on the gaster where it forms a fine yellowish covering, rather thin, by no means hiding the sculpture.

Head a little longer than broad, broadest at the eyes, occipital border and sides strongly convex. Frontal carinae erect, separated by fully their length. Clypeus convex in the middle above, the anterior border convex, with a slight excision at the middle. Eyes globular, placed at the middle of the sides. Scapes of the antennae extending beyond the occipital border by one-third of their length; first segment of the funiculus fully one-third longer than the second, the others subequal. Masticatory border of the mandibles with nine denticles, the terminal border with nine large teeth. Thorax twice as long as broad. Pronotum twice as broad as long, furnished in front with two long slender spines directed forward, outward and downward, their length is equal to two-thirds of the distance apart at their base. Mesonotum longer than broad, broader in front than behind. Epinotum slightly longer than broad, furnished with two long, sharp, stout spines, directed outward and backward; in profile the spines are at an angle of thirty degrees, the dorsum flat, the declivity concave. Node thin on top, fully four times broader than long, concave laterally above, the anterior face feebly concave, the posterior convex; in profile flat in front, the posterior convex. Gaster much longer than broad. Legs long and slender.

*Hab.*: New South Wales: Bondi (E. Zeck, G. F. Hill); Cooma (A. Musgrave).

Near *D. (H.) doriae* Emery, from which it differs in colour, sculpture, form of the node and spines.

DOLICHODERUS (HYPOCLINEA) DENTATA Forel.

Figs. 3 & 3a.

*D. doriae* Emery; var. *dentata* Forel; Rev. Suisse Zool., 10, p. 461, 1902, ♀; Emery, Genera Insect., 137, p. 12, 1912.

*Worker.* Length: 7.7 mm.

Head and gaster black, thorax brown, the epinotum and spines red, mandibles, clypeus, antennae and legs yellowish red.

Shining. Head irregularly punctate-rugose. Clypeus finely striate-rugose longitudinally. Mandibles longitudinally striate and sparsely punctate. Pronotum and mesonotum coarsely punctate, the punctures large and shallow. The epinotum more shining, the punctures much wider apart. Top of the node irregularly rugose. Gaster microscopically reticulate-punctate.

Hair yellow, short and erect, very sparse, except on the gaster, very short on the antennae and legs. Pubescence apparent only on the gaster, where it forms a thin covering, by no means hiding the sculpture.

Head as long as broad, broadest at the eyes, the occipital border straight, the sides strongly convex, the angles rounded. Frontal carinae short, their distance apart equal to their length. Clypeus convex above, the anterior border convex, deeply excised at the middle. Eyes globular, placed at the middle of the sides. Scapes extending beyond the occipital border by fully one-third of their length; first segment of the funiculus one-fifth longer than the second, the others subequal. Mandibles finely denticulate on the masticatory border, the denticles increasing in size from the base to the apex; the terminal border furnished with ten sharp teeth.

Thorax two and three-quarter times longer than broad. Pronotum twice as broad as long, furnished in front with two long, very slender spines directed forward and outward, as long as their distance apart at the base; in profile directed forward and downward, curved towards the apex. Mesonotum circular; in profile feebly convex longitudinally, not so high as the pronotum, there is a strong sharp tooth on the side below. Epinotum longer than broad, furnished with two long, sharp, slender spines directed upward, backward and outward; in profile they are at an angle of about forty degrees, the dorsum straight, the declivity concave. Node barely three times broader than long, the anterior and posterior borders straight, the dorsum feebly concave. Gaster longer than broad, the anterior face concave below. Legs long and slender.

*Hab.*: Queensland, Mackay (G. Turner).

Differs from *D. (H.) doriae* Emery, by the colour, spines and node, as well as by the large tooth on the sides of the mesonotum.

DOLICHODERUS (HYPOCLINEA) EXTENSISPINOSA Forel.

Figs. 4 & 4a.

*D. (H.) doriae* Emery; race *extensispinosa* Forel, Arkiv. f. Zool., 16, p. 76, 1915, ♀.

*Worker.* Length: 8.5-8.8 mm.

Brown. Mandibles, antennae and legs reddish, epinotum and spines more or less reddish.

Shining. Head, thorax and dorsum of the node coarsely and irregularly punctate, clypeus more finely so. Mandibles finely reticulate, with sparse shallow punctures. Gaster microscopically punctate.

Hair yellow, erect, moderately long and abundant throughout. Pubescence yellow, apparent only on the gaster, where it forms a dense golden clothing, completely hiding the sculpture.

Head longer than broad, almost as broad in front as behind, occipital border and sides convex. Frontal carinae feebly diverging behind, their distance apart equal to their length. The anterior border of the clypeus convex, with a slight concave excision at the middle. Eyes globular, placed slightly behind the middle of the sides. Scapes extending beyond the occipital border by fully one-third of their length; first segment of the funiculus barely twice as long as the second, third as long as the second. Mandibles with the masticatory border finely denticulate, the terminal border with nine to ten sharp teeth. Thorax two and a quarter times longer than broad. Pronotum one-fourth broader than long, furnished with a long slender spine on each side in front, directed outward at a right angle and slightly upward. Mesonotum longer than broad; in profile somewhat saddle-shaped, convex in front, concave behind. Epinotum longer than broad, furnished with two long slender spines directed upward, backward and outward; in profile they are abruptly bent backward near the base, then rise at an angle of forty degrees, the dorsum straight, the declivity at an obtuse angle. Node twice as broad as long, the anterior face feebly concave, the posterior face straight, the sides and top convex. Gaster longer than broad, concave in front below. Legs long and slender.

*Hab.*: Queensland, Blackall (type locality, E. Mjöberg); Samford (H. Hacker).

The spines of the pronotum distinguish this from all the other species. In the three preceding species the spines are directed forward almost parallel with the thorax, whilst in the present species they project at right angle.

## DOLICHODERUS (HYPOCLINEA) SCABRIDUS Roger.

Figs. 5 &amp; 5a.

*D. scabridus* Roger, Berl. Ent. Zeitschr., 6, p. 244, 1862, ♀.*Polyrhachis foveolata* Lowne, The Entomologist, Lond., 2, p. 334, 1865, ♀.

♀; Jour. Mus. Godeffroy, 12, p. 79, 1876, ♀.

*Dolichoderus (Hypoclinea) scabridus* Roger; Emery, Genera Insect., 137, p. 13, 1912, ♀.*Worker.* Length: 6.2-6.8 mm.

Black. Legs red, spines of the epinotum reddish brown, mandibles and antennae brown, sometimes blackish brown.

Shining. Head, thorax and node coarsely and irregularly punctate, those on the mesonotum and epinotum larger and more scattered than on the head, finely and densely reticulate between the punctures. Clypeus rugose. Mandibles sparsely punctate. Gaster microscopically punctate.

Hair yellow, short and erect, moderately abundant throughout. Pubescence apparent only on the gaster, where it forms a distinct yellow clothing, but not hiding the sculpture.

Head slightly longer than broad, convex behind and on the sides. Frontal carinae erect, parallel, longer than their distance apart. The anterior border of the clypeus convex, feebly excised in the middle. Eyes globular, placed at the middle of the sides. Scapes extending beyond the occipital border by one-third of their length; first segment of the funiculus twice as long as the second and third. The masticatory border of the mandibles with eight denticles; the terminal border with nine or ten sharp teeth. Thorax twice as long as broad. Pronotum fully one-third broader than long, convex in front and on the sides. Mesonotum circular. Epinotum as long as broad, furnished with two long sharp spines, directed upward, outward and backward; in profile the dorsum convex, the declivity slightly concave, the spines rising at an angle of thirty degrees. Node twice as broad as long, the anterior border straight, the sides and posterior border convex; in profile parallel, the dorsum convex. Gaster concave in front below. Legs long and slender.

*Male.* Length: 4-5 mm.

Black. Mandibles, scapes and legs brown, metanotum red.

Subopaque. Head, pronotum, scutellum and mesonotum coarsely punctate, the punctures shallow and scattered, the spaces between them densely reticulate. Top of the epinotum finely reticulate, the declivity and node finely transverse striate. Gaster densely and finely punctate.

Hair yellow, erect, long and abundant throughout. Pubescence whitish, very fine and adpressed on the antennae and legs, longer and more abundant on the gaster.

Head longer than broad, broader behind than in front, the occipital border and sides strongly convex. Frontal carinae short and erect. Clypeus convex above, the anterior border strongly convex, with a feeble excision in the middle. Eyes large and convex, slightly in front of the middle, occupying one-third of the sides. Ocelli large and prominent. Scapes fully three times as long as the first segment of the funiculus and twice as long as the second. Mandibles large and triangular, finely and densely striate, furnished with numerous very fine sharp teeth. Pronotum hardly visible from above. Mesonotum large and convex, without traces of mayrian or parapsidal furrows. Scutellum convex. Epinotum short and broad, convex above; in profile as long as the declivity, the latter descending at an obtuse angle. Node thick, twice as broad as long, the anterior face and dorsum concave, the posterior face convex. Gaster longer than broad.



Cerci very long and thick. Genitalia partly retracted, the outer and middle processes long and slender, strongly curved downward. Legs long and slender. Wings subhyaline, with a slight smoky tinge.

*Hab.*: New South Wales: Sydney (W. W. Froggatt, -H. P. Schrader); Lismore (C. F. Deuquet); Albury (F. E. Wilson).

DOLICHODERUS (HYPOCLINEA) SCABRIDUS Roger, var. RUFICORNIS Sants.

Figs. 6 & 6a.

Bull. Soc. Ent. Fr., 10, p. 175, 1916, ♀.

*Worker.* Length: 5-5.5 mm.

Similar to *D. (H.) scabridus* Rog., from which it differs in colour and formation of the spines.

Brown. Mandibles, antennae and legs red, gaster black. Sculpture and pilosity identical. The spines of the epinotum shorter and less diverging; in profile they are barely as long as the dorsum of the epinotum; in *scabridus* they are at least one-fourth longer.

*Male.* Length: 4-4.5 mm.

*Hab.*: South Australia: Mount Lofty (A. H. Elston); Myponga (A. H. Elston). Victoria: Ararat (G. F. Hill); Mount William (J. Clark); Maldon (J. C. Goudie); Ferntree Gully (F. P. Spry); Cann River (J. Clark).

Differ from the male of *scabridus* only in having the mandibles, scapes and legs red. Wings slightly brownish.

DOLICHODERUS (HYPOCLINEA) YPSILON Forel.

Figs. 7 & 7a.

*Dolichoderus scabridus* Rog.; race *ypsilon* Forel, Rev. Suisse Zool., 10, p. 461, 1902.

*Dolichoderus ypsilon* Forel, Fauna Sudwest. Australia, 1, p. 284, 1907, ♀, ♂; Arkiv. f. Zool., 16, p. 76, 1915; Emery, Genera Insect., 137, p. 13, 1912, ♀, ♂.

*Worker.* Length: 5.3-5.8 mm.

Black. Legs and spines red, mandibles and coxae darker red.

Shining. Head punctate, the punctures shallow, the spaces between them finely reticulate. Pronotum and mesonotum with somewhat similar punctures, but more scattered. Top of the node coarsely rugose. Gaster microscopically punctate.

Hair yellow, long and erect, abundant throughout, shorter and suberect on the antennae and legs. Pubescence very fine and adpressed on the antennae, coxae and legs, longer and more abundant on the gaster, where it forms a yellowish clothing, not hiding the sculpture.

Head slightly longer than broad, the occipital border and sides convex. Frontal carinae short and parallel, as long as their distance apart. Clypeus with a distinct median groove from the base to the anterior border, the latter convex with a deep excision in the middle. Scapes extending beyond the occipital border by one-third of their length; first segment of the funiculus one-fourth longer than the second, and twice as long as the third. Eyes globular, placed at the middle of the sides. The masticatory border of the mandibles furnished with fine denticles; terminal border with strong sharp teeth. Thorax one and two-thirds times longer than broad. Pronotum one-third broader than long, convex above. Mesonotum slightly broader than long, feebly convex above. Epinotum short, as long as broad, furnished with two long sharp spines, directed upward, outward and backward, meeting at their base; in profile the dorsum short, almost fully occupied by the base of the spines, they are nearly straight and rise at an angle of sixty degrees, the declivity abrupt, longer than the basal face.



Node fully twice as broad as long, concave in front, convex behind, the dorsum straight; in profile parallel, to near the top, the dorsum and posterior face united in a convexity. Gaster longer than broad, concave in front below. Legs long and slender.

*Male.* Length: 4-4.8 mm.

Yellowish red, gaster darker, apical segments brown.

Opaque. Scutellum, epinotum, node and gaster more or less shining.

Head and mesonotum very finely reticulate and with some very shallow scattered punctures.

Hair yellow, erect, abundant throughout. Pubescence whitish, hardly apparent, except on the antennae and legs.

Head almost as broad as long, strongly convex behind and on the sides. Frontal carinae short and erect. Clypeus convex above, produced in front. Eyes very large and convex, occupying a little more than half the sides of the head. Ocelli very large and globular. Scapes fully three times longer than the first segment of the funiculus, and almost twice as long as the second. Mandibles furnished with numerous small sharp teeth. Mesonotum overhanging and hiding the pronotum in front; mayrian furrows not apparent, parapsidal furrows sharply impressed. Scutellum almost circular, broader than long. Epinotum short and broad; in profile convex longitudinally, the declivity abrupt, as long as the dorsum. Node one and one-third times broader than long. Gaster much longer than broad. Cerci long and stout. Outer and middle processes of the genitalia slender, strongly curved downward at the points. Wings hyaline, with a slight smoky tinge. Legs long and slender.

*Hab.*: Western Australia. Widely distributed in the south-west corner from Geraldton to Albany.

In general appearance this species is much like *D. scabridus*, but is readily separated by its finer build and sculpture; the spines, too, are differently shaped.

*DOLICHODERUS (HYPOCLINEA) YPSILON* Forel, var. *NIGRA* Crawley.

Figs. 8 & 8a.

*Ann. Mag. Nat. Hist.*, 9, 10, p. 25, 1922, ♀.

*Worker.* Length: 5.5-5.8 mm.

Differs from *D. ypsilon* Forel, as follows: Entirely black, legs blackish brown. Spines of the epinotum longer and more slender and more distinctly curved. The node a little smaller and sharper above. Sculpture and pilosity identical.

*Hab.*: Western Australia: Armadale, Mundaring and Perth (J. Clark).

*DOLICHODERUS (HYPOCLINEA) YPSILON* Forel, var. *RUFOTIBIALIS* n. var.

Figs. 9 & 9a.

*Worker.* Length: 6-6.5 mm.

Differs from *D. ypsilon* Forel, as follows:—

Apical margins of the mandibles, trochanters, knees, tibia and tarsi red; antennae and femora brown. The spines of the epinotum shorter and thicker, the dorsum of the epinotum longer. The mesonotum level, with the pronotum and epinotum forming almost a straight back. The tooth on the side of the mesonotum much less pronounced. The node thinner below, much more convex behind.

*Hab.*: Western Australia: Albany (J. Clark).

*DOLICHODERUS* (HYPOCLINEA) *ANGUSTICORNIS* n.sp.

Figs. 10 &amp; 10a.

*Worker*. Length: 6.3-6.7 mm.

Black. Legs and apical half of the spines brownish red.

Subopaque. Mandibles shining with large scattered punctures. Head coarsely punctate-rugose. Clypeus longitudinally rugose. Thorax with very large shallow punctures, densely reticulate between and in the punctures. Epinotal declivity shining, finely transverse striate. Node strongly striate transversely behind. Gaster densely and microscopically punctate.

Hair yellow, erect, long and abundant throughout, shorter and suberect on the legs. Pubescence not apparent, except on the gaster, where it forms a yellowish, rather coarse covering, hiding the sculpture.

Head as long as broad, broader behind than in front, the occipital border straight, the sides strongly convex. Frontal carinae separated by fully their length. Clypeus convex above, the anterior border feebly convex, almost straight, not excised in the middle. Eyes globular, placed at the middle of the sides. Scapes extending beyond the occipital border by one-third of their length; first segment of the funiculus one-third longer than the second, the others subequal. The masticatory border of the mandibles feebly denticulate; the terminal border with seven or eight strong sharp teeth. Thorax one and one-third times longer than broad. Pronotum almost one and three-quarter times broader than long, convex above. Mesonotum circular, convex above, there is a strong sharp tooth on the sides below. Epinotum as broad as long, furnished with two long slender, almost parallel spines, feebly directed outward above; in profile the spines rise at an angle of seventy-five degrees, their base occupying almost all the surface of the epinotum, the declivity abrupt and straight, one and a half times longer than the dorsum. Node three times broader than long, rather deeply concave on top, the anterior face concave, the posterior convex. Gaster longer than broad, concave in front below. Legs long and slender.

*Hab.*: Western Australia: Burracoppin (G. Cadd).

Resembles *D. ypsilon* Forel, in colour, but is readily separated by the form of the head, spines and node.

*DOLICHODERUS* (HYPOCLINEA) *SCROBICULATUS* Mayr.

Figs. 11 &amp; 11a.

Emery. *Genera Insect.*, 137, p. 13, 1912. ♀.

*Hypoclinea scrobiculata* Mayr, *Jour. Mus. Godeffroy*, 12, p. 79 & 80, 1876. ♀.

*Worker*. Length: 4.5-4.8 mm.

Black, the thorax sometimes brownish black, mandibles and scapes red, funiculus and legs darker.

Shining. Head, thorax and node coarsely punctate. Clypeus more striate-rugose. Mandibles smooth, with some large shallow punctures. Gaster microscopically punctate.

Hair yellow, erect, long and abundant throughout, shorter on the antennae and legs. Pubescence apparent only on the gaster, where it forms a thin yellowish covering, not hiding the sculpture.

Head longer than broad, the occipital border feebly, and the sides strongly, convex. Frontal carinae dilated at the middle, as long as their distance apart. Clypeus convex above, the anterior border convex, with a deep and wide excision in the middle. Eyes globular, placed slightly behind the middle of the sides. Scapes extending beyond the occipital border by one-fourth of their length; first segment of the funiculus one third longer

than the second and third. The masticatory border of the mandibles finely denticulate, the terminal border with ten or twelve sharp teeth. Thorax one and a half times longer than broad. Pronotum almost three times broader than long, feebly convex above. Mesonotum convex above. Epinotum as long as broad, the sides and posterior border feebly convex; in profile the dorsum strongly convex longitudinally, much higher in front than behind, overhanging the declivity, the latter slightly longer than the dorsum and strongly concave. Node barely twice as broad as long, the anterior face feebly, the posterior face strongly, convex; in profile parallel to near the top, where both faces are convex, meeting and forming a ridge on the dorsum. Gaster concave in front below. Legs robust.

*Hab.*: Queensland: Brisbane (H. Hacker); Bribie Island (H. Hacker); Toowoomba (W. B. Barnard); Rockhampton (H. J. Carter). New South Wales: Sydney (W. W. Froggatt).

DOLICHODERUS (HYPOCLINEA) TURNERI Forel.

Rev. Suisse Zool., 10, p. 462, 1902, ♀.

Emery, Genera Insect., 137, p. 13, 1912, ♀.

*Worker.* Length: 3.4-4.5 mm.

Head triangular or almost cordiform, strongly reduced in front, with strongly convex sides, broadly emarginate behind. Mandibles large, smooth and shining, punctate, armed in front with one large and three small teeth, and a series of very small denticles, about eight or nine. Clypeus impressed longitudinally on its anterior half. Scapes pass the occiput a little. Eyes placed behind the middle, at the posterior two-fifths. Pronotum broad, bluntly produced. Sutures of the thorax strongly impressed; in profile forming three successive convexities of almost equal length, situated on the same horizontal plane, feebly sub-bordered. The basal face of the epinotum almost square, terminated by a sharp ridge overhanging the declivity, the latter high and deeply concave, the superior half of the sides marginate (shape analogous to that of *D. taschenbergi*, *mariae* and *quadripunctatus*). Node very thick, much broader than the epinotum, rounded above, about four times broader than thick. Abdomen large, slightly concave in front.

Head and thorax strongly, coarsely and irregularly reticulate-punctate, node a little more feebly so; bottom of the punctures shining and feebly sculptured. Face of the declivity feebly and transversely striate. Abdomen very finely and densely punctate, subopaque, members less densely punctate, rather shining. An erect pilosity, fine and pointed, spread on the body, shorter and suberect on the antennae and legs. Pubescence greyish yellow, moderately long on the abdomen, node, antennae and legs, partly hiding the sculpture on the abdomen.

Head thorax and anterior legs reddish brown. Mandibles, antennae node, abdomen and the rest of the legs yellow russet or brownish.

The whole insect short and massive.

*Hab.*: Queensland: Mackay (G. Turner).

I have not seen this species, but it appears to be very distinct from all the other known forms.

DOLICHODERUS (HYPOCLINEA) REFLEXUS n.sp.

Figs. 13 & 13a.

*Worker.* Length: 4-4.3 mm.

Red. Mandibles, antennae, legs and gaster testaceous; on some examples there are two dark bands on the gaster. Eyes black, funiculus brown.

Shining. Head, thorax and node coarsely punctate, with a fine reticulation between the punctures. Gaster microscopically punctate.

Hair yellow, long and erect, abundant throughout, shorter on the antennae and legs. No pubescence apparent.

Head slightly longer than broad, strongly convex behind and on the sides. Frontal carinae diverging behind, slightly longer than their distance apart. Clypeus convex above, the anterior border convex, with a distinct concave excision in the middle. Eyes globular, placed at the middle of the sides. Scapes extending beyond the occipital border by one-fourth of their length; first segment of the funiculus one-fifth longer than the second, third slightly shorter than the second. Thorax one and two-thirds times longer than broad. Pronotum twice as broad as long, convex in front, the anterior angles bluntly produced, the dorsum feebly concave in the middle. Mesonotum convex above. Epinotum one and a third times longer than broad, convex laterally, the posterior border short and excised in the middle, appearing slightly bilobed; in profile very strongly convex above, dome-shaped, overhanging the declivity by half its length, the declivity short, strongly concave, the superior border margined, the sides submargined. Node fully twice as broad as long, in front it is feebly, behind strongly, convex, the dorsum convex laterally. Gaster longer than broad, concave in front below. Legs robust.

*Hab.*: South Australia: Murray Bridge, Mount Lofty (A. H. Elston).

Apparently near *D. turneri* Forel, but the formation of the head readily separate them.

*DOLICHODERUS* (*HYPOCLINEA*) *CLUSOR* Forel.

Figs. 18 & 18a.

Fauna, Sudwest. Aust., 1, p. 285, 1907, ♀.

Emery, Genera Insect., 137, p. 12, 1912, ♀.

*Worker*. Length: 3.8-4.3 mm.

Brownish-red. Head, except the clypeus, darker; mandibles and legs more yellowish-red, gaster black.

Subopaque, gaster shining. Head punctate-reticulate, the punctures large, shallow and scattered. Pronotum finely reticulate, with large shallow punctures. Mesonotum more coarsely punctate-reticulate. Epinotum finely rugose. Gaster microscopically reticulate.

Hair yellow, long and erect, abundant throughout, shorter and sub-erect on the antennae and legs.

Head longer than broad, the occipital border short and straight, the sides and angles strongly convex. Frontal carinae diverging slightly behind, as long as their distance apart. Clypeus convex above, the anterior border convex, with a distinct concave excision in the middle. Eyes large and convex, placed at the middle of the sides. Scapes extending beyond the occipital border by one-third of their length; first segment of the funiculus one-fourth longer than the second, third slightly shorter than the second. Mandibles smooth, with shallow scattered punctures, the masticatory with feeble denticles; the terminal border with ten to twelve sharp teeth. Thorax one and three-quarter times longer than broad, convex in front and on the sides, the angles bluntly rounded; flattened or feebly concave above. Mesonotum convex above. Epinotum one-third longer than broad, convex laterally, the posterior border convex; in profile strongly convex above, very slightly overhanging the declivity, the latter concave, margined on the sides and above. Node three times broader than long, feebly concave in front, convex behind and above. Gaster longer than broad, concave in front below. Legs robust.

*Hab.*: Western Australia: Fremantle, Perth, Armadale, Ludlow (J. Clark).

This species comes closest to *D. australis* Andre, from Victoria.



## DOLICHODERUS (HYPOCLINEA) AUSTRALIS Andre.

Figs. 19 &amp; 19a.

Rev. d'Ent., p. 105, 1896, ♀.

Emery, Genera Insect., 137, p. 12, 1912, ♀.

*Worker*. Length: 4.5-4.8 mm.

Head and gaster black, thorax and node red, mandibles, antennae and legs brownish-red, brown on some examples.

Subopaque. Gaster smooth and shining. Head very finely and densely punctate, with some large, very shallow, scattered punctures. Mandibles smooth with a few scattered punctures. Pronotum almost smooth, microscopically reticulate. Mesonotum and epinotum more distinctly reticulate, with a few large shallow punctures. Node reticulate above.

Hair yellow, long and erect, abundant throughout, shorter and sub-erect on the antennae and legs. No pubescence apparent.

Head one-fourth longer than broad, as broad in front as behind, the occipital border and sides convex. Frontal carinae diverging behind, slightly longer than their distance apart. Clypeus convex above, with a longitudinal groove in the middle, more apparent in front than behind, anterior border convex, with a deep excision in the middle. Eyes large and rather flattened. Scapes extending beyond the occipital border by fully one-third of their length; first segment of the funiculus one-fourth longer than the second. Masticatory border of the mandibles feebly denticulate; the terminal border with eleven sharp teeth. Thorax twice as long as broad. Pronotum one-fourth broader than long, flattened above, on some examples it is feebly concave longitudinally. Mesonotum convex above. Epinotum as long as broad, strongly convex laterally, the posterior border convex; in profile strongly convex, higher in front than behind, not, or very slightly, overhanging the declivity, the latter concave, as long as the dorsum. Node three times broader than long, the anterior face feebly, the dorsum and posterior face strongly, convex; in profile scale-like, the anterior face straight, the posterior strongly convex. Gaster longer than broad, concave in front below. Legs robust.

*Hab.*: Victoria: Ferntree Gully (F. P. Spry); Ringwood (F. E. Wilson); Warburton (L. B. Thorn); Maldon (J. C. Goudie).

## DOLICHODERUS (HYPOCLINEA) PARVUS n.sp.

Figs. 16 &amp; 16a.

*Worker*. Length: 3-3.2 mm.

Yellowish red, mandibles and antennae testaceous, legs clear yellow, gaster brown.

Shining. Head very finely reticulate. Mandibles smooth. Pronotum microscopically reticulate. Mesonotum reticulate, coarser than on the head. Epinotum and node rugose. Gaster shining, microscopically punctate.

Hair yellow, long and erect, abundant throughout, shorter on the antennae and legs. No pubescence apparent.

Head one-fifth longer than broad, the posterior border feebly, the sides strongly convex. Frontal carinae diverging behind, longer than their distance apart. Clypeus convex above, the anterior border convex, with a distinct excision in front. Eyes large and convex, occupying fully one-fourth of the sides of the head. Scapes extending beyond the occipital border by barely one-fourth of their length; first segment of the funiculus one-third longer than the second, third slightly longer than the second. Mandibles finely denticulate on the masticatory border; terminal border with ten large sharp teeth. Thorax twice as long as broad. Pronotum slightly broader than long, flattened above, convex in front and on the

sides. Mesonotum convex above. Epinotum as long as broad, the posterior border convex; in profile strongly convex longitudinally, not overhanging the declivity, the latter concave, barely as long as the dorsum. Node scale-like, four times broader than long, the anterior face straight, the dorsum and posterior face convex. Gaster longer than broad, concave in front below. Legs slender.

*Hab.*: Victoria: Sea Lake (J. C. Goudie).

A very distinct species, not near any other known.

*DOLICHODERUS* (HYPOCLINEA) *GOUDIEI* n.sp.

Figs. 17 & 17a.

*Worker.* Length: 3.6-4 mm.

Black. Mandibles, antennae and legs brown.

Subopaque. Head reticulate-punctate, the punctures large and scattered. Mandibles finely punctate. Pronotum smooth, microscopically punctate, with some large scattered punctures. Mesonotum finely rugose; epinotum coarsely so. Gaster densely and microscopically punctate.

Hair yellow, erect, moderately long and abundant throughout. Pubescence yellow, rather long and close lying, longer and more abundant on the gaster, where it forms a distinct clothing almost hiding the sculpture.

Head slightly longer than broad, the occipital border straight, or very feebly convex, the sides convex. Frontal carinae hardly diverging, a little longer than their distance apart. Clypeus convex above, with a deep longitudinal groove in the middle from the base to the anterior border, the latter convex, excised in the middle. Scapes extending beyond the occipital border by fully one-fourth of their length; first segment of the funiculus one-fifth longer than the second, the third slightly shorter than the second. Masticatory border of the mandibles with fine denticles; the terminal border with ten to twelve strong sharp teeth. Thorax barely twice as long as broad. Pronotum one-fourth broader than long, flattened above. Mesonotum convex above. Epinotum slightly longer than broad, convex; in profile the dorsum convex, dome-shaped, the declivity as long as the dorsum, concave towards the bottom, the slightly overhanging superior border and sides margined. Node four times broader than long; in profile scale-like, thick at the base and tapering to a blunt point above. Gaster feebly concave in front below. Legs robust.

*Hab.*: Victoria: Maldon (J. C. Goudie).

This species is readily distinguished from all others by the strongly pubescent gaster, colour, sculpture and thin node.

*DOLICHODERUS* (HYPOCLINEA) *NIGRICORNIS* n.sp.

Figs. 14 & 14a.

*Worker.* Length: 4-4.3 mm.

Bright red. Eyes and gaster black, antennae and legs brownish black, mandibles and clypeus yellowish red.

Subopaque, gaster shining. Head coarsely and irregularly punctate. Clypeus longitudinally striate, almost rugose. Pronotum rugose, but not coarsely so, with some large shallow punctures at the sides. Mesonotum and epinotum coarsely rugose. Gaster microscopically punctate.

Hair yellow, short and erect, abundant throughout, but a little longer and more numerous on the gaster. Pubescence not apparent.

Head one-sixth longer than broad, the occipital border feebly, the sides strongly convex. Frontal carinae slightly longer than their distance apart. Clypeus convex above, the anterior border convex, feebly indented

in the middle. Eyes small and convex. Scapes extending beyond the occipital border by one-third of their length; first segment of the funiculus one-fifth longer than the second, third as long as the second. Mandibles furnished with twelve sharp teeth. Thorax twice as long as broad. Pronotum almost twice as broad as long, the anterior border feebly convex, the angles bluntly rounded, the dorsum concave longitudinally; in profile flat above, the anterior face short and abrupt, the angles produced outward and forward. Mesonotum convex above. Epinotum longer than broad, convex laterally, the posterior border straight; in profile strongly convex longitudinally, overhanging the declivity, the latter strongly concave, one-third shorter than the dorsum, the superior border sharply margined. Node almost three times as broad as long, feebly concave in front, strongly convex above and behind. Gaster longer than broad, concave in front below. Legs long and robust.

*Hab.*: Western Australia: Tammin (J. Clark).

The produced angles of the pronotum readily distinguish this from all the other species.

**DOLICHODERUS (HYPOCLINEA) FORMOSUS n.sp.**

Figs. 15 & 15a.

*Worker.* Length: 4.5-5 mm.

Head and gaster black, mandibles and thorax red, antennae and legs brown, or reddish brown. On a few examples the head is blackish brown, the clypeus lighter.

Subopaque. Coxae, node and gaster smooth and shining. Head coarsely punctate and finely reticulate. Clypeus finely longitudinally striate. Thorax punctate-rugose and finely reticulate.

Hair yellow, erect, rather short, but abundant throughout, suberect on the antennae and legs. Pubescence not apparent.

Head longer than broad, as broad behind as in front, the occipital border feebly, the sides strongly, convex. Frontal carinae as long as their distance apart. Clypeus convex above, the anterior border convex, with a deeply excised concavity in the middle. Eyes large, convex, placed at the middle of the sides. Scapes extending beyond the occipital border by barely one-third of their length; first segment of the funiculus one-tenth longer than the second, the other subequal. Masticatory border of the mandibles feebly denticulate, terminal border with nine or ten strong sharp teeth. Thorax twice as long as broad. Pronotum one and two-third times broader than long, convex in front, the angles bluntly rounded, depressed, or feebly concave longitudinally above. Epinotum one and one-third times longer than broad, the posterior border convex; in profile strongly convex longitudinally, one-third longer than the declivity, the latter strongly concave. Node slender, three times as broad as long, the dorsum convex; in profile both faces convex toward the top, the latter bluntly pointed. Gaster longer than broad, feebly concave in front below. Legs robust.

*Female.* Length: 6.8 mm.

Similar to the worker, but much larger and winged. The colour is brighter. On the mesonotum there is a large black spot on the anterior margin and an elongate black spot on each side near the middle. The scutellum is smooth and shining, the gaster very finely and densely punctate. Wings missing.

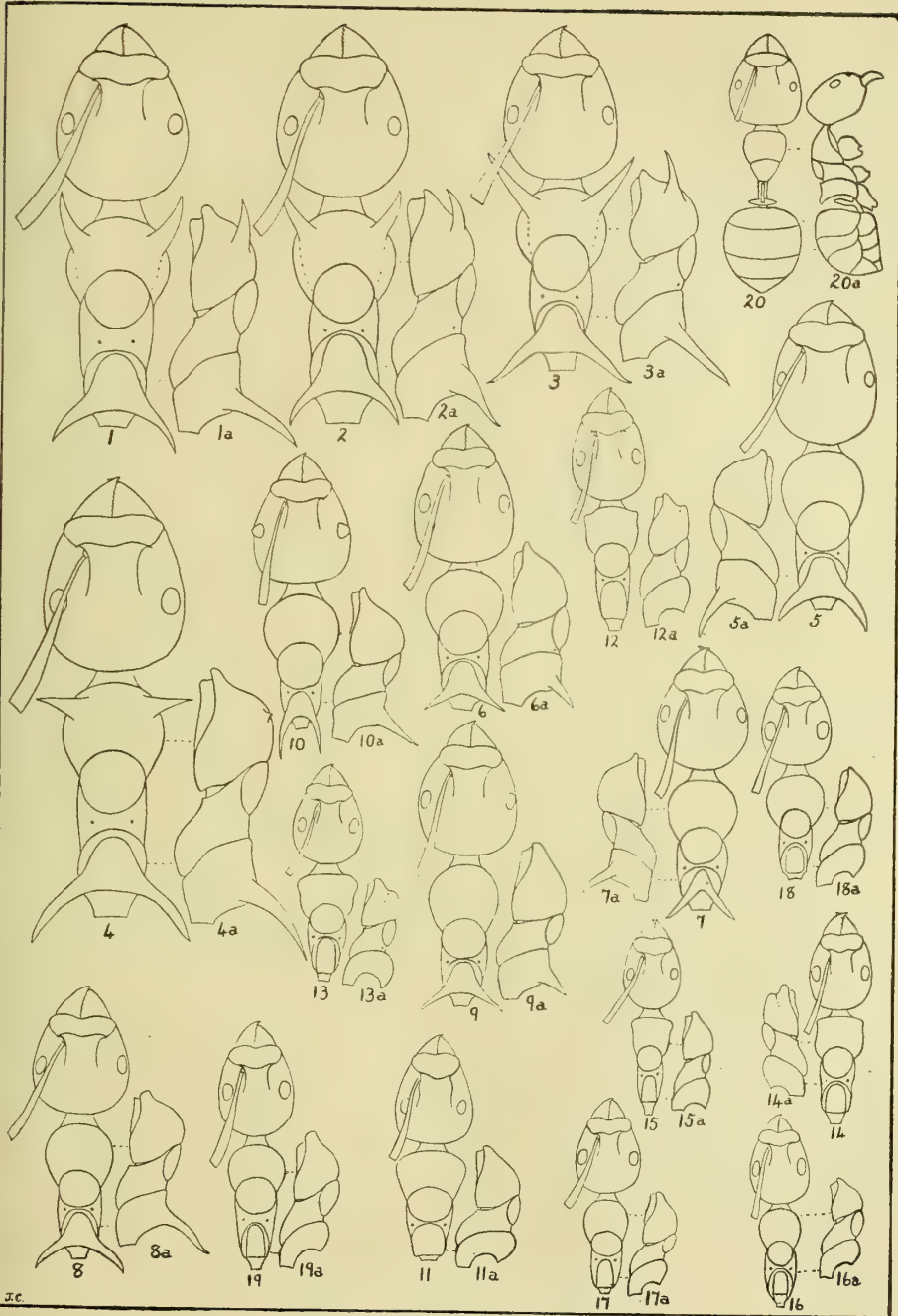
*Hab.*: Western Australia: Armadale, Mundaring, Mount Dale (J. Clark).

Near *D. nigricornis*, but readily distinguished by the colour, sculpture, shape of the thorax and node.

## EXPLANATION OF FIGURES.

1. *Dolichoderus* (*Hypoclinea*) *doriae* Emery. Dorsal view. a, profile of thorax.
2. *Dolichoderus* (*Hypoclinea*) *tristis* n.sp. Dorsal view. a, profile of thorax.
3. *Dolichoderus* (*Hypoclinea*) *dentata* Forel. Dorsal view. a, profile of thorax.
4. *Dolichoderus* (*Hypoclinea*) *extensispinosa* Forel. Dorsal view. a, profile of thorax.
5. *Dolichoderus* (*Hypoclinea*) *scabridus* Roger. Dorsal view. a, profile of thorax.
6. *Dolichoderus* (*Hypoclinea*) var. *ruficornis* Santschi. Dorsal view. a, profile of thorax.
7. *Dolichoderus* (*Hypoclinea*) *ypsilon* Forel. Dorsal view. a, profile of thorax.
8. *Dolichoderus* (*Hypoclinea*) var. *nigra* Crawley. Dorsal view. a, profile of thorax.
9. *Dolichoderus* (*Hypoclinea*) var. *rufotibialis* n.var. Dorsal view. a, profile of thorax.
10. *Dolichoderus* (*Hypoclinea*) *angusticornis* n.sp. Dorsal view. a, profile of thorax.
11. *Dolichoderus* (*Hypoclinea*) *scrobiculatus* Mayr. Dorsal view. a, profile of thorax.
12. *Dolichoderus* (*Hypoclinea*) *occidentalis* n.sp. Dorsal view. a, profile of thorax.
13. *Dolichoderus* (*Hypoclinea*) *reflexus* n.sp. Dorsal view. a, profile of thorax.
14. *Dolichoderus* (*Hypoclinea*) *nigricornis* n.sp. Dorsal view. a, profile of thorax.
15. *Dolichoderus* (*Hypoclinea*) *formosus* n.sp. Dorsal view. a, profile of thorax.
16. *Dolichoderus* (*Hypoclinea*) *parvus* n.sp. Dorsal view. a, profile of thorax.
17. *Dolichoderus* (*Hypoclinea*) *goudiei* n.sp. Dorsal view. a, profile of thorax.
18. *Dolichoderus* (*Hypoclinea*) *clusor* Forel. Dorsal view. a, profile of thorax.
19. *Dolichoderus* (*Hypoclinea*) *australis* Andre. Dorsal view. a, profile of thorax.
20. *Iridomyrmex* *flavipes* Kirby. Dorsal view. a, profile of thorax.



Australian Ants of the Genus *DOLICHODERUS*.

*DOLICHODERUS* (HYPOCLINEA) OCCIDENTALIS n.sp.

Figs. 12 &amp; 12a.

*Worker*. Length: 4.7-5 mm.

Black. Mandibles and legs brownish black.

Subopaque. Head and thorax coarsely punctate, slightly coarser on the thorax, almost rugose. Mandibles finely punctate. Gaster microscopically punctate.

Hair yellow, erect, moderately long and abundant throughout. Pubescence very fine and adpressed on the gaster.

Head one-fifth longer than broad, the occipital border feebly, the sides strongly convex. Frontal carinae parallel, longer than their distance apart. Clypeus convex above, the anterior border convex, with a feeble excision in the middle. Eyes convex, placed at the middle of the sides. Scapes extending beyond the occipital border by one-third of their length; first segment of the funiculus slightly longer than the second, third as long as the second. Mandibles with ten to twelve sharp teeth. Thorax twice as long as broad. Pronotum one-fourth broader than long, the anterior angle very bluntly produced forward, forming a concavity in front. Mesonotum convex above. Epinotum one-third longer than broad; in profile strongly convex, the posterior border inclined slightly upward, overhanging the declivity, the latter shorter than the dorsum, margined above and on the sides. Node rather slender, three times as broad as long, feebly concave in front, convex above and behind. Gaster longer than broad, concave in front below. Legs long and robust.

*Hab.*: Western Australia: Albany (J. Clark).

Near *D. scrobiculatus* Mayr, but readily separated from it by the form of the pronotum and node. From *D. nigricornis*, it differs by the colour, pilosity and the form of the epinotum and node.

*IRIDOMYRMEX FLAVIPES* Kirby.

Figs. 20 &amp; 20a.

*Hypoclinea flavipes* Kirby, Result Horn. Exped. Zool. Suppl. 1, p. 206, 1896, ♀; Froggatt, Cat. Aust. Ants. Agric. Gaz., p. 22, 1905, ♀.

*Iridomyrmex rostrinotus* Forel, Rev. Suisse Zool., 18, p. 53, 1910, ♀, ♂, ♀; Emery, Genera Insect., fasc., 137, p. 26, 1912; Crawley, Ann. Mag. Nat. Hist., 9, 16, p. 595, 1925, ♀.

The type of *Hypoclinea flavipes* Kirby, is in the collection of the National Museum. It has been compared with cotypes of *Iridomyrmex rostrinotus* Forel. They are identical.

The description given by Kirby for *H. flavipes* is not only useless, it is absurd.

The description of *I. rostrinotus* Forel, is very complete, but I may add that the colour of the legs varies from brown to yellowish red. I have given figures (20 and 20a) to supplement Forel's description. This figure is from the type of *flavipes*.

This ant has a very wide distribution throughout the central Australian region, being found wherever the Porcupine grass grows. It is known as the "Spinifex Ant."

The late Sir Baldwin Spencer gave a most interesting and complete account of this species in the Narrative of the Horn Expedition, Vol. 1, pp. 69-72, 1896.

## CHECK LIST OF THE AUSTRALIAN CISTELIDAE.

## ORDER—COLEOPTERA.

By H. J. CARTER, B.A.

Plates xviii. &amp; xix.

*Preface.*

The catalogue of Australian Coleoptera, published by Masters, in 1886, enumerated fourteen genera and seventy-one species of this family, of which five genera and nineteen species have since been sunk as synonyms or shown to be superfluous. The present list contains twenty-four genera and one hundred and ninety-eight species, an increase of 71.5 % in genera and 177.5 % in species.

The following genera have been superseded:—

*Atractus* Lac. (nom. praeocc.). Now *Aethysius* Pasc.

*Neotractus* Borch. Superfluous.

*Lisa* Haag. = *Metistete* Pasc.

*Ismarus* Haag. Now *Simarus* Borch.

*Allecula* F. Australian species merged in *Homotrysis* Pasc.

*Cistela* F. Australian species merged in *Nocar* Blkb.

"In the Junk Catalogue, Borchmann followed Seidlitz in substituting the name ALLECULIDAE for CISTELIDAE on the ground that *Cistela* was used by Geoffroy (1764) in another family, and therefore *Cistela* F. (1773) was praeoccupied. Geoffroy's names, however, are not accepted, hence *Cistela* F. is a valid genus, with type *sulphurea* Latr. (1810), and the family name is therefore correctly *Cistelidae*." (1).

The family is clearly separated from the TENEBRIONIDAE by the pectinate claws and the presence of lamellae on the tarsi, of which there are, in the Australian species, two on each of the four anterior and a single lamella on the penultimate segment of the post tarsi. The anterior coxal cavities are, in general, closed behind.

In this family the males, in all species examined, display well-developed genital forceps, somewhat similar to, though less prominent than those in the Phalidurine weevils (2).

These are especially notable in the larger forms of *Hybrenia*, *Homotrysis* and *Metistete*, and in the last genus were noted by Blackburn (3). The females frequently display an extended ovipositor.

The genera show few distinct characters that allow of simple clear cut tabulation; the Darwinian test, a combination of small differences, forming the rule for generic distinction. The species, however, are generally well differentiated by sculpture and frequently by sexual characters, seen in the form of teeth or excisions, associated with the tibiae or femora, besides differences of antennal structure.

An asterisk before a name denotes a species unknown to the author.

The genera may be arranged in two distinct groups:—

*Group I.* Having simple mandibles, acutely pointed, the head produced into a nozzle.

*Group II.* Having bifid mandibles, the head little produced.

These may be tabulated as follows:—

(1). Note reprinted from Tr. Roy. Soc. S.A., 1920, p. 198.

(2). Vide Roy. Soc. Vict., 1915, p. 54 and pl. vi,

(3). Linn. Soc. N.S.W., 1888, p. 1438.

## Group I.

- |  |                     |
|--|---------------------|
| 1. Prothorax oblong or cylindric. . . . .  | 2.                  |
| Prothorax transverse, its sides more or less rounded. . .  | 5.                  |
| 2. Antennal segment 11 nearly or quite as long as 10. . . .  | 3.                  |
| Antennal segment 11 much shorter than 10. . . . .  | <i>Anaxo.</i>       |
| 3. Prothorax cylindric, intercoxal process truncate or rounded. .  | <i>Aethyssius.</i>  |
| Prothorax subdepressed, intercoxal process triangular. . .   | 4.                  |
| 4. Surface metallic (except in <i>A. rufovittis</i> ), ♂ with post tibiae excised and flattened. . . . . | <i>Alcmeonis.</i>   |
| Surface non-metallic, ♂ with post tibiae, and sometimes femora widened. . . . .                          | <i>Chromomoea.</i>  |
| 5. Prothorax widened at middle. . . . .  | <i>Hemicistela.</i> |
| Prothorax widest behind middle. . . . .  | 6.                  |
| 6. Antennae short. . . . .   | 7.                  |
| Antennae long. . . . .   | <i>Tanychilus.</i>  |
| 7. Elytra metallic, irregularly punctate. . . . .  | <i>Eucistela.</i>   |
| Elytra non-metallic, striate-punctate. . . . .   | 8.                  |
| 8. Eyes large and approximate. . . . .   | <i>Apellatus.</i>   |
| Eyes smaller and distant. . . . .  | 9.                  |
| 9. Elytra not wider than base of prothorax, procoxae separated by a lamina. . . . .                      | <i>Neocistela.</i>  |
| Elytra wider than base of prothorax, procoxae contiguous. .  | <i>Atoichus.</i>    |

## Group II.

- |   |                        |
|---|------------------------|
| 1. With wings fully adapted for flight. . . . .   | 2.                     |
| Without wings fully adapted for flight—at least in the ♀. . .                               | 10.                    |
| 2. Mandibles grooved, scarcely bifid, at apex. . . . .                                      | <i>Dimorphochilus.</i> |
| Mandibles distinctly bifid at apex. . . . .   | 3.                     |
| 3. Hind femora extending well beyond elytra when at right angles to suture. . . . .         | 4.                     |
| Hind femora not or scarcely extending beyond elytra when at right angles to suture. . . . . | 8.                     |
| 4. Prothorax widest behind middle. . . . .  | 5.                     |
| Prothorax widest in front of middle. . . . .  | 7.                     |
| 5. Antennal segments more or less elongate and slender. . .                                 | 6.                     |
| Antennal segments short and widened towards apex. . . .                                     | <i>Nypsius.</i>        |
| 6. Elytra striate-punctate. . . . .   | 7.                     |
| Elytra striate only—at least on 3 sutural striae. . . .                                     | <i>Barycistela.</i>    |
| 7. Prothorax very short and transverse. . . . .   | <i>Ommatophorus.</i>   |
| Prothorax subcordate . . . . .  | <i>Iophon.</i>         |
| 8. Form widely ovate. . . . .   | <i>Nocar.</i>          |
| Form oblong ovate. . . . .  | 9.                     |
| 9. Surface convex, antennae very short, widened towards apex. .                             | <i>Taxes.</i>          |
| Surface subdepressed, antennae longer, scarcely widened towards apex. . . . .               | <i>Scaletomerus.</i>   |
| 10. Epipleurae wide (Facies of <i>Otiorrhyncus</i> ). . . . .                               | <i>Simarus.</i>        |
| Epipleurae narrow. . . . .  | 11.                    |
| 11. Prothorax more or less ovate, elytra striate-punctate. . .                              | 12.                    |
| Prothorax cordate, elytra tuberculate. . . . .  | <i>Notocistela.</i>    |
| 12. Epipleurae separated from elytra by carina. . . . .                                     | <i>Metistete.</i>      |
| Epipleurae and elytra subcontinuous without separating carina. . .                          | <i>Melaps.</i>         |



## CHECK LIST OF THE FAMILY CISTELIDAE.

AETHYSSIUS Pasc., Jour. Ent., 1863, 45.

*atractus* Lac., Gen. Cat., 1859, 457.*neoatractus* Borchm., Deutsche. Ent. Zeitschr., 1909, 713.

1. *atriceps* Cart., Roy. Soc. Vic., 1915, 56. . . . . Q.
2. *cyaneus* Macl., Ent. Soc. N.S.W., 1872, 299. . . . . Q.
3. *eros* Pasc., Ann. Mag. Nat. Hist., 1871, 357, pl. 2, fig. 14. . . . . Q.  
Blue Mountains, N.S.W.
4. *flavipes* Macl., Linn. Soc. N.S.W., 1887, 313. . . . . Q.
5. *ruficollis* Macl., Ent. Soc. N.S.W., 1872, 299. . . . . Q.
6. *rugosulus* Mac., l.c., 300. . . . . Q.
7. *virescens* Boisd., Voy. Astrol., 1835, 284. . . . . N.S.W.
8. *viridis* Boisd., l.c., 283. . . . . Q., N.S.W., V., S.A.  
var. *columbinus* Boisd., l.c., 284.  
var. *rubriventris* Cart., Roy. Soc. Vic., 1915, 55.
9. *vitticollis* Macl., Ent. Soc. N.S.W., 1872, 300. . . . . Q.

ALCMEONIS Bates, Trans. Ent. Soc. Lond., 1868, 270.

10. *excisipes* Cart., Roy. Soc. Vic., 1915, 58. . . . . N.S.W., Dorrigo.
11. *paradoxus* Cart., l.c. . . . . N.S.W.
12. *pulchra* Bates, Trans. Ent. Soc. Lond., 1868, 271. . . . . Vic., S.A.
13. *punctulaticollis* Blkb., Roy. Soc. S.A., 1893, 133. . . . . Vic.
14. *rufovittis* Cart., Linn. Soc. N.S.W., 1928, 287, pl. 2, fig. 8. . . . . Vic.

CHROMOMOEAE Pasc., Jour. Ent., 1866, 490.

*Lepturidea* Fauv., Rev. d'Ent., 1905, 225.*Licymnius* Bates, Tr. Ent. Soc. Lond., 1868, 271.

15. *deplanchei* Fauv., Bull. Norm., 1862, 150, pl. 1, fig. 4. . . . . N.S.W., V.
16. *rufipennis* Blkb., Roy. Soc. S.A., 1891, 316.
17. *eleonora* Cart., Linn. Soc. N.S.W., 1925, 243. . . . . Barrington, N.S.W.
18. *fastigiata* Germ. (Allecula), Linn. Ent., 1848, 202. V., S.A., N.S.W., Q.
19. *foveicollis* Bates (Licymnius), Tr. Ent. Soc. Lond., 1868, 272.
20. *fusca* Cart., Roy. Soc. Vict., 1915, 64. . . . . N.S.W., Q.
21. *gracillima* Cart., Roy. Soc. S.A., 1920, 199. . . . . N.Q.
22. *maculicornis* Blkb., l.c., 1891, 315. . . . . Vic.
23. *major* Cart., Linn. Soc. N.S.W., 1928, 288. . . . . N.S.W., Vic.
24. *mastersi* Macl., Ent. Soc. N.S.W., 1872, 300. . . . . N.S.W., Q., V.
25. *metallica* Cart., Linn. Soc. N.S.W., 1930, 187. . . . . N.Q.
26. *nigriceps* Champ., Trans. Ent. Soc. Lond., 1895, 215. . . . . W.A. (1).
27. *occidentalis* Blkb. (Anaxo), Roy. Soc. S.A., 1891, 311. . . . . W.A.
28. *ochracea* Cart., Roy. Soc. Vic., 1915, 55. . . . . N.S.W., Q.
29. *oculata* Cart., Linn. Soc. N.S.W., 1925, 243. . . . . S.Q.
30. *opacicollis* Cart., Roy. Soc. Vic., 1915, 65. . . . . Sydney, N.S.W.
31. *ornata* Cart., l.c., 63. . . . . N.Q.
32. *pallida* Bates, Trans. Ent. Soc. Lond., 1868, 319. . . . . N.S.W.
33. *pascoei* Bates, l.c., 317. . . . . N.S.W., Q.
34. *vittata* Bates, l.c., 318.
35. *picea* Macl., Ent. Soc. N.S.W., 1872, 300. . . . . Q.
36. *picta* Pasc., Jour. Ent., 1866, 491. . . . . N.S.W., Q.
37. *puncticeps* Blkb. (Anaxo), Roy. Soc. S.A., 1891, 311. . . . . N.S.W., Vic.
38. *rufescens* Bates, Trans. Ent. Soc. Lond., 1868, 320. . . . . N.S.W.

(1). *nigriceps* Champ., locality erroneously published as Hobart, Tasmania; corrected by author in letter to me. H.J.C.

36. *strigicollis* Fairm. (Licymnius), Petites Nouv. Ent., 1879, 167. . . . . Peak Downs, Q.  
 . . . . . Journ. Mus. Godeff., 1879, 110.  
 (? *Aethyssius vitticollis* Macl.)
37. *suturalis* Cart., Linn. Soc. N.S.W., 1930, 187. . . . . Dorrigo, N.S.W.
38. *tibialis* Cart., Linn. Soc. N.S.W., 1921, 321. . . . . N.Q.
39. *unicolor* Bates, Trans. Ent. Soc. Lond., 1868, 320. . . . . N.S.W., Vic., S.A.  
*aereus* Blkb. (Anaxo), Roy. Soc. S.A., 1891, 308.  
 var. *sydneyanus* Blkb. (Anaxo), l.c., 1893, 134.  
 var. *lindensis* Blkb. (Anaxo), l.c., 1891, 309.  
 ? var. *affinis* Blkb. (Anaxo), l.c., 1891, 309.
40. *varicornis* Cart., Linn. Soc. N.S.W., 1926, 514. . . . . N.Q.
41. *violacea* Cart., l.c., 1922, 80. . . . . Barrington, N.S.W.
42. *vittipennis* Macl. (Atractus), l.c., 1887, 313. . . . . Q.

ANAXO Bates, Trans. Ent. Soc. Lond., 1868, 272.

43. *ater* Blkb., Roy. Soc. S.A., 1891, 310. . . . . Vic.
44. *brevicornis* Bates, Trans. Ent. Soc. Lond., 1868, 273. . . . . S.A., V.
45. *cylindricus* Germ., Linn. Ent., 1848, 202. . . . . S.A., V.  
 var. *obscurus* Blkb., Roy. Soc. S.A., 1891, 309.
46. *cylindricollis* Cart., Linn. Soc. N.S.W., 1927, 233. . . . . W.A.
47. *dentipes* Cart., Roy. Soc. S.A., 1920, 200. . . . . W.A.
48. *fuscoviolaceus* Fairm., Petit. Nouv. Ent., 1879, 167. . . . . Q.
49. *sparsus* Blkb., Roy. Soc. S.A., 1891, 310. . . . . Vic.
50. *strongylioides* Cart., l.c., 1920, 201. . . . . Q.

HEMICISTELA Blkb., Roy. Soc. S.A., 1891, 331.

51. *discoïdalis* Blkb., l.c., 332, pl. 1, fig. 1. . . . . V., N.S.W., Q.
52. *testacea* Cart., l.c., 1920, 202. . . . . W.A.

APELLATUS Pasc., Jour. Ent., 1863, 45.

*euomma* Boh., Res. Eug., 1858, 101.

53. *amoenus* Pasc., Jour. Ent., 1866, 491, pl. 2, fig. 9. . . . . N.S.W., V., S.A.,  
*lateralis* Pasc., l.c., 45.
54. *apicalis* Blkb., Linn. Soc. N.S.W., 1888, 1440. . . . . W.A.
55. *concolor* Cart., Roy. Soc. Vic., 1915, 70. . . . . Brisbane, Q.
56. *lateralis* Boh., Res. Ent., 1858, 101. . . . . Q., N.S.W., V., S.A.  
*palpalis* Macl., Ent. Soc. N.S.W., 1872, 298.  
*mastersi* Macl., l.c., 299.
57. *lineatus* Cart., Roy. Soc. Vic., 1915, 70. . . . . W.A.
58. *nigricornis* Blkb., l.c., 1891, 315. . . . . Vic.
59. *nigripes* Cart., l.c., 1915, 71. . . . . W.A.
60. *nodicornis* Blkb., l.c., 1891, 314. . . . . Vic.
61. *plebejus* Cart., l.c., 1915, 69. . . . . S.A.
62. *stplex* Cart., l.c., 68. . . . . N.S.W. Q.
63. *tasmanicus* Champ., Trans. Ent. Soc. Lond., 1895, 215. . . . . T.

EUCISTELA Cart., Linn. Soc. N.S.W., 1922, 79.

64. *cyanea* Cart., l.c., 80, pl. 1, fig. 2. . . . . N.Q.

NEOCISTELA Borchm., Deutsche Ent. Zeitschr., 1909, 713.

*Pseudocistela* Blkb., Roy. Soc. S.A., 1891, 316.  
 (nom. praecoc.)

65. *ovalis* Blkb., l.c., 317. . . . . N.S.W., Vic.

*ATOICHUS* Cart., Roy. Soc. Vic., 1915, 72.

66. *bicolor* Blkb. (Licymnius), l.c., 1893, 133. . . . . S.A., V., N.S.W.  
 67. *crassicornis* Cart., l.c., 1915, 74. . . . . Brisbane, Q.  
 68. *dimidiatus* Cart., Linn. Soc. N.S.W., 1924, 544. . . . . Bribie Is., Q.  
 69. *flavipes* Cart., l.c., 543. . . . . Bribie Is., Q.  
 70. *flavus* Cart., Roy. Soc. Vic., 1915, 73. . . . . Vic.  
 71. *tasmanicus* Cart., l.c., 72. . . . . T.

*TANYCHILUS* Newm., Ent. Mag., 1838, 487.

72. *aeratus* Cart., Linn. Soc. N.S.W., 1926, 515. . . . . Tamb. Mt., Q.  
 73. *dubius* Newm., Ent. Mag., 1838, 488. . . . . N.S.W., Vic.  
     var. *splendens* Bless., Hor. Ross., 1861, 111.  
 74. *minor* Cart., Roy. Soc. Vic., 1915, 75. . . . . Sydney, N.S.W.  
 75. *opaeus* Cart., Linn. Soc. N.S.W., 1917, 715. . . . . N.T.  
 76. *pulcher* Cart., Roy. Soc. Vic., 1915, 75. . . . . N.T.  
 77. *ruber* Cart., l.c., 76. . . . . N.S.W., S.Q.  
 78. *striatus* Newm., Ent. Mag., 1838, 487. . . . . V., N.S.W., Q.

Two species also from New Zealand, *T. metallicus* White, and *T. sophorae* Brown.

*DIMORPHOCHILUS* Borchm., Faun. Sud. West. Aust., 1908, 352.

79. *diversicollis* Borchm., l.c., 354. . . . . W.A.  
     ? var. *apicalis* Borchm., l.c., 353.  
 80. *gouldi* Hope (Allecula), Proc. Ent. Soc. Lond., 1842, 80. . . . . N.T.  
 81. *pascoei* MacL. (Metistete), Ent. Soc. N.S.W., 1872, 299, pl. 1, fig. 6. Q.  
 82. *sobrinus* Borchm., Faun. Sud. West. Aust., 1908, 356. Dirk Hartog Is.

*HOMOTRYSIS* Pasc., Jour. Ent., 1866, 489.

83. *aenescens* Cart., Linn. Soc. N.S.W., 1921, 322. . . . . Stanthorpe, Q.  
 84. *aerea* Cart., l.c. . . . . Macleay R., N.S.W.  
 85. *arida* Blkb., Roy. Soc. S.A., 1895, 53. Central A.; also Bogan R., N.S.W.  
     *sitiens* Blkb., l.c.

*callabonensis* Blkb., l.c.

86. *bicolor* Champ., Trans. Ent. Soc. Lond., 1895, 217. . . . . T.  
 87. *canescens* Hope, Proc. Ent. Soc. Lond., 1842, 80, pl. 2, fig. 11. . . . .  
     . . . . . Port Essington, N.T., & Tennant's Cr.  
     *maculata* Haag., Jour. Mus. Godeffr., 1879, 136.

88. *carbonaria* Germ., Linn. Ent., 1842, 202. . . . . V., S.A.  
     *tristis* Germ., l.c.

89. *cisteloides* Newm., Ent. Mon. Mag., 1838, 488. . . . . N.S.W., V., S.A.  
     *javeicollis* Hope (Allecula), Proc. Ent. Soc. Lond., 1842, 80.  
     *fuscipennis* Bless., Hor. Soc. Ent. Ross., 1861, 112.  
     *microderes* Pasc., Jour. Ent., 1866, 489.

- 90.\* *costata* Haag., Verh. Ver. Hamb., 1878, 105. . . . . Q.  
     Jour. Mus. Godeffr., 1879, 137.

91. *curticornis* Haag., l.c., 105. . . . . Q.  
     l.c., 136.

- 92.\* *cylindricollis* Boisd., Voy. Astrol., 1832, 283. . . . . A.

93. *debilicornis* Haag., Verh. Ver. Hamb., 1878, 105. . . . . Q.  
     Jour. Mus. Godeffr., 1879, 136.

94. *doddi* Cart., Roy. Soc. S.A., 1920, 205. . . . . W.A.

95. *flavicornis* MacL., Linn. Soc. N.S.W., 1887, 316. . . . . Q.  
     *macleayi* Borchm., Junk. Cat., 1910, 11.

96. *fusca* Blkb., Roy. Soc. S.A., 1891, 326. . . . . S.A.

97. *kershawi* Cart., l.c., 1920, 204. . . . . Eucla, W.A.

98. *laticollis* Boh. (Allecula), Res. Eug., 1858, 100. . . . . N.S.W., V., S.A.

99. *limbata* Blkb., Roy. Soc. S.A., 1891, 323. . . . . N.S.W., V.  
 100. *luctuosa* Champ., Trans. Ent. Soc. Lond., 1895, 216. . . . . T.  
 101.\* *lugubris* Blkb., Roy. Soc. S.A., 1891, 322. . . . . Vic.  
 102. *mastersi* Macl. (Allecula), Ent. Soc. N.S.W., 1872, 302. . . . . Q.  
 103. *nigricans* Hope (Allecula), Proc. Ent. Soc. Lond., 1842, 80. . . . . N.T.  
     also Roy. Soc. S.A., 1920, 203.  
 104. *obscura* Borchm., Faun. Sud. West. Aus., 1908, 51. . . . . W.A.  
 105. *ornata* Cart., Roy. Soc. Vic., 1915, 84. . . . . N.Q.  
 106. *pallipes* Cart., l.c., 1920, 204. . . . . N.Q.  
 107. *pascoei* Macl. (Allecula), Ent. Soc. N.S.W., 1872, 302. . . . . Q., N.S.W., V.  
 108. *planicollis* Macl. (Allecula), l.c., 303. . . . . Q., N.S.W., V.  
 109. *post-tibialis* Cart., Roy. Soc. S.A., 1920, 206. . . . . W.A., V.  
 110. *regularis* Macl., Ent. Soc. N.S.W., 1872, 301. . . . . Q., N.S.W., S.A.  
 111.\* *rotundicollis* Casteln. (Allecula), Hist. Nat., 1840, 243. . . . . A.  
 112. *rubicunda* Cart., Roy. Soc. Vic., 1915, 85. . . . . N.Q.  
 113. *rufa* Blkb., l.c., 1891, 324. . . . . S.A.  
 114. *ruficornis* Macl., Ent. Soc. N.S.W., 1872, 301. . . . . Q.  
 115. *rufipes* F. (Helops), Syst. Ent., 1775, 258. . . . . N.S.W., Q.  
     *angusticollis* Boh. (Allecula), Res. Eug., 1858, 100.  
     ? *australis* Boisd. (Allecula), Voy. Astrol., 1835, 282.  
 116. *rufipilis* Cart., Linn. Soc. N.S.W., 1928, 289. . . . . N.Q.  
 117. *rufo-coerulea* Cart., Roy. Soc. S.A., 1920, 206. . . . . N.Q.  
 118. *rufulicornis* Borchm., Junk. Cat., 1910, 18. . . . . Q.  
     *ruficornis* Blkb., Roy. Soc. S.A., 1891, 322.  
 119.\* *scabrosa* Champ., Trans. Ent. Soc. Lond., 1895, 218. . . . . W.A.  
 120. *scutellaris* Cart., Roy. Soc. S.A., 1920, 207. . . . . Q., N.S.W.  
 121. *subgeminatus* Macl., Ent. Soc. N.S.W., 1872, 301. . . . . Q.  
 122. *tenebrioides* Blkb., Roy. Soc. S.A., 1891, 325. . . . . N.S.W., Q., S.A.  
 123. *torpedo* Cart., Linn. Soc. N.S.W., 1922, 81. . . . . S.Q.  
 124. *variolora* Cart., Roy. Soc. S.A., 1920, 208. . . . . Scone, N.S.W.
- HYBRENIA* Pasc., Jour. Ent., 1866, 489.
125. *angustata* Macl., Linn. Soc. N.S.W., 1887, 315. . . . . Q.  
 126. *angusticollis* Cart., l.c., 1928, 289. . . . . Townsville, Q.  
 127. *clermontia* Cart., l.c., 1930, 188. . . . . Clermont, Q.  
 128. *dentipes* Cart., l.c., 1929, 76. . . . . N.Q.  
 129. *elongata* Macl. (Allecula), Ent. Soc. N.S.W., 1872, 301. . . . . N.S.W., Q.  
 130. *femorata* Cart., Roy. Soc. Vic., 1915, 89. . . . . N.Q.  
 131. *grandis* Borch., Faun. S.W. Aust., 1908, 349. . . . . N.S.W., V. (? W.A.).  
 132. *horni* Cart., Ent. Mitteil., 1928, 138. . . . . Q.  
 133. *illidgei* Cart., Linn. Soc. N.S.W., 1927, 233. . . . . Nat. Park, Q.  
 134. *laticollis* Macl., l.c., 1887, 314, pl. 2, fig. 13. . . . . Q.  
 135. *nitida* Blkb. (Homotrysis), Roy. Soc. S.A., 1891, 326. . . . . N.Q., N.T.  
 136. *nitidior* Cart., Roy. Soc. Vic., 1915, 90. . . . . N.S.W., S.Q.  
 137. *occidentalis* Cart., Roy. Soc. S.A., 1920, 209. . . . . W.A.  
 138. *pallida* Cart., Roy. Soc. Vic., 1915, 89. . . . . C. York, N.Q.  
 139. *pilosa* Cart., Roy. Soc. S.A., 1920, 210. . . . . W.A.  
 140. *pimelioides* Hope (Allecula), Ent. Soc. Lond., 1842, 79. . . . . N.S.W., V., N.T.  
     *princeps* Blkb., Roy. Soc. S.A., 1891, 325.  
 141. *planata* Cart., Roy. Soc. Vic., 1915, 88. . . . . N.S.W., V., S.A.  
 142. *rugicollis* Cart., l.c., 87. . . . . N.S.W.  
 143. *sublaevis* Macl., Linn. Soc. N.S.W., 1887, 315. . . . . Q.  
 144. *substriata* Cart., l.c., 1926, 515. . . . . Q.  
 145. *subsulcata* Macl., Ent. Soc. N.S.W., 1872, 302. . . . . N.S.W., Q.  
 146. *tibialis* Cart., Linn. Soc. N.S.W., 1929, 77. . . . . N.Q.  
 147. *torrida* Cart., Roy. Soc. S.A., 1920, 210. . . . . N.T.



148. *vittata* Pasc., Jour. Ent., 1866, 490. . . . . Q., N.T.  
     *insularis* Pasc., l.c.  
     *subvittata* Macl., Linn. Soc. N.S.W., 1887, 314.  
     var. *concolor* Cart., Roy. Soc. Vic., 1915, 87.
149. *yeppoonensis* Cart., Linn. Soc. N.S.W., 1928, 289. . . . . Q.  
     *NYPSIUS* Champ., Ent. Soc. Lond., 1895, 219.
150. *aeneopiceus* Champ., l.c., 219. . . . . T. (also Alpine, N.S.W., V.)
151. *foveatus* Champ., l.c., 220. . . . . T. (also Alpine, N.S.W., V.)  
     *OMMATOPHORUS* Macl., Ent. Soc. N.S.W., 1872, 304.
152. *atripes* Cart., Roy. Soc. Vic., 1915, 92, pl. 2, fig. 12. . . . . N.S.W., Q.  
     var. *bicolor* Cart., Linn. Soc. N.S.W., 1926, 516.
153. *boops* Cart., l.c., 1930, 188. . . . . N.Q.
154. *illidgei* Cart., l.c., 1926, 516. . . . . Q.
155. *mastersi* Macl., Ent. Soc. N.S.W., 1872, 305. . . . . Q.  
     ? *rugulosa* Boisd., Voy. Astrol., 1835, 282.
- IOPHON* Champ., Ent. Soc. Lond., 1895, 224.
156. *myrmecophilus* Champ., l.c., 225. . . . . N.T.  
     *BARYCISTELA* Blkb., Roy. Soc. S.A., 1891, 327.
157. *robusta* Blkb., l.c., 328. . . . . V., N.S.W., Q.  
     *NOCAR* Blkb., Roy. Soc. S.A., 1891, 328.
158. *australicus* Blkb. (Cistela), Linn. Soc. N.S.W., 1888, 1441, pl. 1, fig. 7.  
     . . . . . Q., N.T.
159. *convexus* Macl., Ent. Soc. N.S.W., 1872, 303. . . . . Q.
160. *depressiusculus* Macl., l.c. . . . . N.S.W., V., S.A., Q., T.  
     *ovatus* Macl., l.c.  
     *debilis* Blkb., Roy. Soc. S.A., 1891, 329.  
     var. *latus* Blkb., l.c.
161. *rugosus* Cart., Roy. Soc. Vic., 1915, 93. . . . . Q.
162. *securigerus* W. S. Macl. (Cistela), King's Surv. Aust., 1827, 443. N.W.A.
163. *simplex* Blkb., Roy. Soc. S.A., 1891, 330. . . . . S.A.  
     *TAXES* Champ., Ent. Soc. Lond., 1895, 226.
164. *alphitobioides* Champ., l.c., 227. . . . . N.T.
165. *depressus* Champ., l.c., 226. . . . . W.A.
166. *subfasciatus* Cart. (Nocar), Roy. Soc. S.A., 1920, 211. . . . . N.W.A.  
     *SCALETOMERUS* Blkb., Roy. Soc. S.A., 1891, 330.  
     *Otys* Champ., Ent. Soc. Lond., 1895, 221.
167. *armatus* Champ., l.c., 223. . . . . N.W.A.
168. *bicolor* Cart., Roy. Soc. Vic., 1915, 95. . . . . N.W.A.
169. *pallens* Champ., Ent. Soc. Lond., 1895, 223. . . . . W.A.
170. *politus* Macl. (Cistela), Ent. Soc. N.S.W., 1872, 304. Q., N.S.W., V., S.A.  
     *harpaloides* Blkb., Roy. Soc. S.A., 1891, 330.
171. *proximus* Blkb., l.c., 331. . . . . S.A., W.A.  
     *harpalinus* Champ., Ent. Soc. Lond., 1895, 222.
- SIMARUS* Borch., Deuts. Ent. Zeit., 1909, 713.  
     *Ismarus* Haag., Verh. Ver. Hamb., 1878, 104.
172. *carinatus* Haag., Jour. Mus. Godeff., 1879, 135, pl. 1, fig. 3. . . . . S.A.
173. *elongatus* Cart., Roy. Soc. Vic., 1915, 95. . . . . W.A.
174. *godeffroyi* Haag., Verh. Ver. Hamb., 1878, 104. . . . . Q.  
     Jour. Mus. Godeff., 1879, 134.

- METISTETE* Pasc., Jour. Ent., 1866, 489.  
*Lisa* Haag., Jour. Mus. Godeff., 1879, 134.
175. *armata* Cart., Roy. Soc. Vic., 1915, 97. . . . . W.A.  
 176. *clarki* Cart., Roy. Soc. S.A., 1920, 212. . . . . W.A.  
 177. *costatipennis* Champ., Ent. Soc. Lond., 1895, 221. . . . . N.W.A.  
 178. *ebenina* Cart., Roy. Soc. Vic., 1915, 98. . . . . S.A., W.A.  
 179. *gibbicollis* Newm., Ent. Mag., 1838, 488. . . . . N.S.W., V., S.A.  
       *melancholica* Hope, Ent. Soc. Lond., 1842, 79.  
 180. *incognita* Blkb., Horn Exp., 1896, 280. . . . . C.A.  
 181. *lindi* Blkb., Linn. Soc. N.S.W., 1888, 1438. . . . . S.A.  
 182. *omophloides* Hope, Ent. Soc. Lond., 1842, 80, pl. 1, fig. 5. . . . . S.A., V.  
       *singularis* Haag. (*Lisa*), Jour. Mus. Godeff., 1879, 135.  
 183. *protibialis* Cart., Roy. Soc. S.A., 1920, 213. . . . . S.A., W.A.  
 184. *punctipennis* Macl. (*Allecula*), Ent. Soc. N.S.W., 1872, 302. . . . . Q.  
 185. *rubicunda* Cart., Roy. Soc. S.A., 1920, 212. . . . . N.T.  
 186. *subopaca* Cart., Linn. Soc. N.S.W., 1922, 81. . . . . N.Q.  
 187. *vicina* Cart., Roy. Soc. S.A., 1920, 214. . . . . Q.

*MELAPS* Cart., Linn. Soc. N.S.W., 1908, 409.

? *Oocistela* Borchm., Faun. S.W. Aust., 1908, 356.

188. *cisteloides* Cart., Linn. Soc. N.S.W., 1908, 409. . . . . Kosciusko, N.S.W.  
 189. *convexus* Borchm. (*Oocistela*), Faun. S.W. Aust., 1908, 356. . . . . W.A.  
 190. *dentipes* Cart., Roy. Soc. S.A., 1920, 214. . . . . S.A.  
 191. *glaber* Cart., l.c., 216. . . . . S.A.  
 192. *pilosus* Cart., Roy. Soc. Vic., 1915, 101. . . . . S.A., W.A.  
 193. *punctatus* Cart., l.c., 100. . . . . Blue Mts., N.S.W.  
 194. *tibialis* Cart., Roy. Soc. S.A., 1920, 216. . . . . W.A.  
 195. *victoriae* Cart., Roy. Soc. Vic., 1915, 99. . . . . Alps, Vic.

*NOTOCISTELA* Cart., Roy. Soc. Vic., 1915, 102.

196. *dispar* Cart., Linn. Soc. N.S.W., 1922, 82. . . . . Ooldea, S.A.  
 197. *pustulata* Cart., Roy. Soc. Vic., 1915, 103. . . . . W.A., C.A.  
 198. *tibialis* Cart., l.c., 102, pl. 2, fig. 10. . . . . W.A.

EXPLANATION OF PLATE XVIII.

- Figure 1. *Hemicistela discoidalis* Blkb.  
 „ 2. *Eucistela cyanea* Cart.  
 „ 3. *Simarus carinatus* Hamp.  
 „ 4. *Chromomoea deplanchei* Fvl.  
 „ 5. *Metistete omophloides* Hope.  
 „ 6. *Dimorphochilus pascoei* Macl.  
 „ 7. *Nocar australicus* Blackb.

PLATE XIX.

- Figure 8. *Alcmeonis rufo-vittatus* Cart.  
 „ 9. *Apellatus amoenus* Pasc. ♂  
 „ 10. *Notocistela tibialis* Cart. ♂.  
 „ 11. *Homotrysis canescens* Hope. ♀.  
 „ 12. *Ommatophorus atripes* Cart.  
 „ 13. *Hybrenia laticollis* Macl.  
 „ 14. *Aethyssius eros* Pasc. ♂.

# THE LORICATES OF THE NEW CALEDONIAN REGION.

(CLASS MOLLUSCA—ORDER LORICATA.)

By A. F. BASSET HULL and JEAN RISBEC, D.Sc.

Plate xx.

## *Prefatory Note.*

During August and September, 1925, I visited New Caledonia, collecting in the vicinity of Noumea, on the south-western coast, and Bourail, on the central western coast. Nine days were spent on a visit to the Loyalty Islands, collecting being carried out on Mare and Lifü.

From July to September, 1926, another visit was paid to New Caledonia, and, with more time at my disposal, I was able to conduct more intensive collecting around Noumea, besides spending twelve days on a trip up the eastern coast, as far as the Island of Pam, during which I collected at Tchio, Wagap and other ports of call.

On both occasions I had the advice and assistance of M. Jean Risbec, then Professeur at the College, La Perouse, Noumea, who was occupying his leisure in a study of the New Caledonian Nudibranchs. He subsequently visited Paris and published an exhaustive monograph of this Molluscan group, presenting it as a thesis, for which he gained the degree of Docteur ès-Sciences. He very kindly examined and made drawings of the radulas of the New Caledonian Loricates which I had collected, and agreed to collaborate with me in the production of the following account of the latter group. He has collected at many localities I was unable to visit, and has critically examined the breeding of some species under captive conditions in aquaria. The dissection and drawing of the internal organs are his work.

—A. F. BASSET HULL.

## THE NEW CALEDONIAN REGION.

For the purpose of this account the New Caledonian region embraces the Island of New Caledonia and its Dependencies, including the Islands of Pott and Art in the extreme north, the Isle of Pines in the extreme south, and the Loyalty Islands, about 50 miles to the eastward of New Caledonia. The whole region being between 161° and 166° east longitude and 19° and 23° south latitude (Paris).

The main island and its immediate outliers are of extremely varied geological formation, with extensive barrier and fringing coral reefs. The Loyalty Islands are entirely of raised coral, Mare and Lifü showing at least four successive periods of uplift, evidenced by cliffs weathered into caves crowned by raised beaches.

This wealth of variety in the littoral rock is marked by an abundance of Loricata fauna in relation to the sedimentary rocks, and a notable scarcity in relation to the igneous rocks. The most prolific grounds exist in the south west, where the rocks are mostly limestone, quartzites and schists, with fringing coral reefs.

## *Previous Literature*

The literature of the New Caledonian Loricates is very scanty, consisting merely of descriptions of several species collected in the islands. Soubervie described six species, assigned to the New Caledonian region, in the *Journal de Conchyliologie*, 1866, 248-254, and 1873, 287. Rochebrune named ten species in the *Bulletin de la Société Philomathique de Paris*, 1881-1884. Both authors, however, have separately described species since found to be conspecific, and the latter author re-described some of Soubervie's species. Furthermore, Rochebrune's descriptions are almost useless, and his classification is, in several instances, obviously incorrect. Thiele (Revision Chitonon [Chun's *Zoologica*, heft 56] 1909-10) examined Rochebrune's types and revised both his nomenclature and classification.

Finally, Hedley described one species from the Isle of Pines (Proc. Linn. Soc. N.S.W., xxiii., 1900, 100, fig.). Full reference to previous descriptions will be found in the synonymy attached to each species herein described.

*General Discussion as to the Relative Importance of Anatomical Characters, Considered as Specific or Generic Characters of the Loricata.*

The Molluscan Order Loricata consists of an extremely homogeneous group, and all the genera present a closely related anatomical structure. In addition, the organs of separate individuals of the same species show great variability. These two facts in conjunction show how difficult it would be to distinguish the species if too great importance is attached to a study of the internal characters. The radula, in itself so characteristic in the Prosobranch group (notwithstanding important individual variations) can here be made use of only with difficulty. It is very variable in individuals of the same species, and it is also very difficult to study. The large second lateral, distinctly visible with its coloured cusps, and which seems to provide very clear and easily established characters, varies, alas! along the radular ribbon. The anatomical characters of the Loricata, therefore, provide only a secondary means of differentiation, and the study of the valves and the girdle remains the only certain basis for the grouping of the forms studied.

It seems, then, that following the animal groups, the conception of the genus may be variable. The established genera of the Loricata differ less among themselves (in regard to the less important characters) than those of the Prosobranchiate group, for example. The result of a study of the anatomical characters alone, according to the plan adopted in relation to the Prosobranchs, would be to cause all the Loricates to be united under one genus.

I. FAMILY ISCHNOCHITONIDAE.

1. Genus ISCHNOCHITON Gray, 1847.

1. ISCHNOCHITON ACOMPHUS n.sp.

(a). *The Shell.*

Shell small,\* elongate oval, elevated, semi-carinated, side slopes convex. Colour variable, creamy-buff, mottled with bluish-green, principally on the

*Explanation of Figures.*

Fig. 1.—Anterior part of the ventral surface of the body. a—mouth, b—buccal hood, c—foot, d—gill.

Fig. 2.—Posterior part of the ventral surface. a—anus, b—foot, c—gill.

Fig. 3.—View of a gill seen from the ventral surface; the point is directed towards the foot. Magnification: 40.

Fig. 4.—Sub-radular organ. Magnification: about 40.

Fig. 5.—View of the stomach drawn beneath the radular sac and observed laterally. The dotted part is that on which the radular sac rested. The surface, which is normally posterior, is in front in this figure, the anterior surface is beneath. a—oesophagus, b—stomach.

Fig. 6.—Stomachic region in its normal position. a—oesophagus, b—stomach, c—radular sac, d—papillary sacs, e—posterior part of bulb. Magnification: 25.

Fig. 7.—Papillae of the papillary sacs.

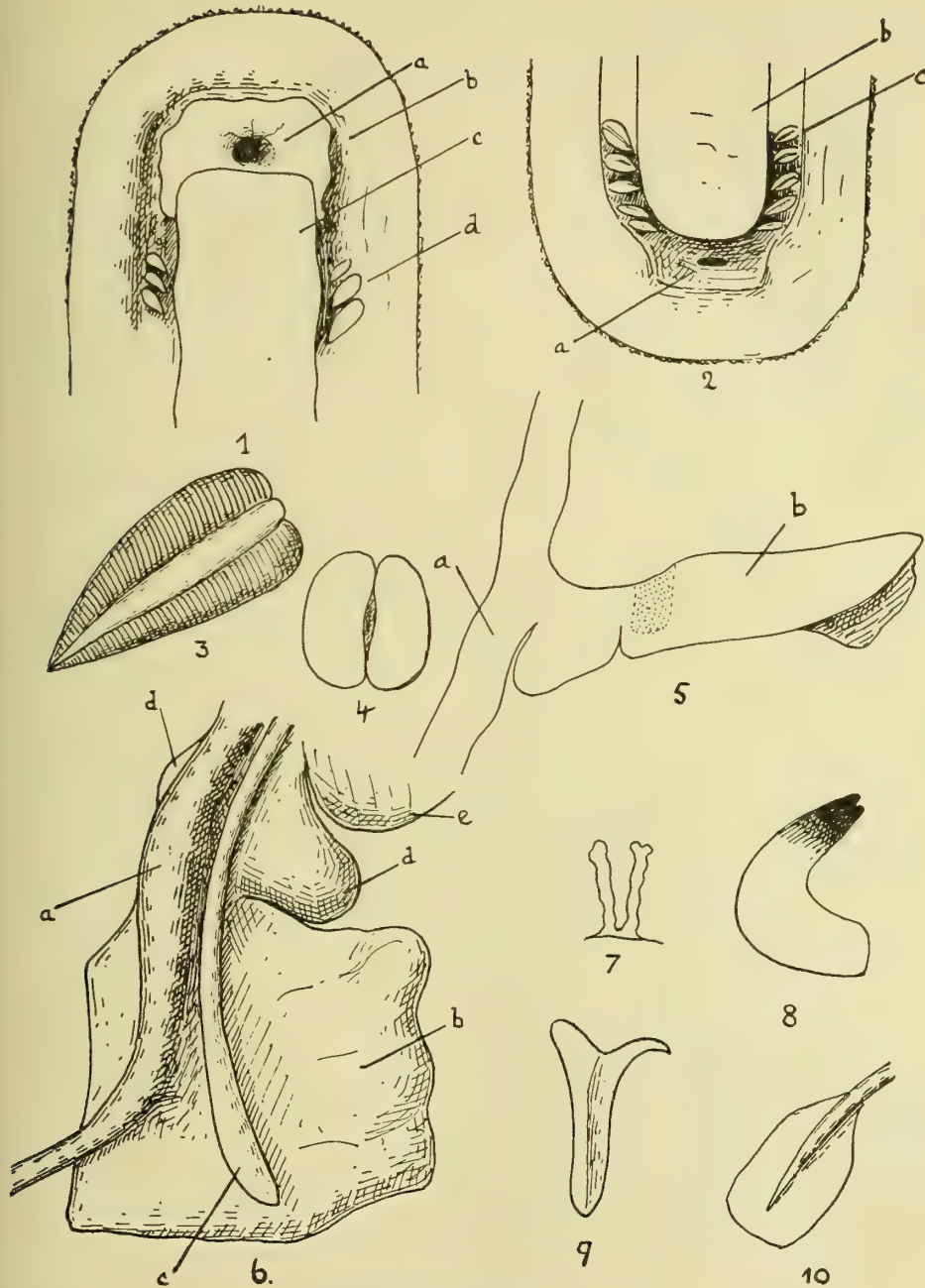
Fig. 8.—A view of the second lateral radular tooth.

Fig. 9.—Central radular tooth seen laterally. Magnification: 300.

Fig. 10.—Enlarged palate of the fourth lateral radular.

\*We have adopted Iredale and Hull's "arbitrary standard" of measurement, viz.: "Small" means under 15 mm. for an average adult specimen; "Medium" over 15 and under 30 mm., and "Large" over 30 mm. in length.





ISCHNOCHITON ACOMPHUS.  
Figs. 1 to 10.

sides of the jugum and on the outer margins of the valves (type); wholly creamy-buff, pink, or greenish, and these colours more or less extensively mottled with dark green, brown or black, sometimes in bilaterally symmetrical pattern, sometimes irregularly.

Anterior valve rayed with about thirty fine low ribs, formed by the apices of about fifteen concentric rows of irregularly shaped pustules, which diminish towards and finally disappear on the apex.

Median valves finely sculptured throughout, with minutely nodulose rays branching outward and forward from the jugum; lateral areas well differentiated, sculptured in zig-zag, and having two or three raised ribs formed by the more or less pustulose projections of the sculpture.

Posterior valve with the mucro post-median; ante-mucronal area sculptured similarly to the central areas; post-mucronal area having a distinct raised diagonal and sculptured weakly like the anterior valve, but with about twenty ribs only.

Girdle densely clothed with somewhat irregular oval striated scales, in eight to ten ridges.

Interior white. Slits, 8—1—9. (Figure on plate shows only 7 slits in the anterior valve, but one "tooth" is obviously abnormally unslit, the slit rays numbering eight).

Dimensions: 14 x 8 mm.

Station: On the under side or at margin of insertion in the sand of stones, dead shells or coral, between median and low tide marks.

Habitat: New Caledonia; not yet recorded from the Loyalty Islands.

Remarks. This shell is very common in the vicinity of Noumea, in the harbour, on the islands at the entrance, in the Baie de l'Orphelinat and on the Anse Vata. It is closely related to *Ischnochiton intermedius* Hedley and Hull, of Norfolk Island, but the sculpture is notably finer, and the colour variation is not nearly so great.

#### (b). *The Animal.*

*External characters.* The foot, ivory-coloured, is rather narrow. The mouth is surrounded by a hood-like fold extending laterally to frame the anterior portion of the foot (Fig. 1). The anus, situated quite near the posterior extremity of the foot, is oval in form, the largest dimension transversally. Twenty-two or 23 gill-rows may be counted on each side of the body. These gill-rows disappear a little behind the anterior extremity of the foot, and extend right up to the posterior extremity (Figs. 1 and 2). The gills have a bulky axis, carrying numerous lamellae. Fig. 3 shows the appearance of the gill, which one sees viewing the animal from its ventral surface; the point of the gill is directed towards the foot.

*Appearance of the internal organs.* The genital organs form a mass

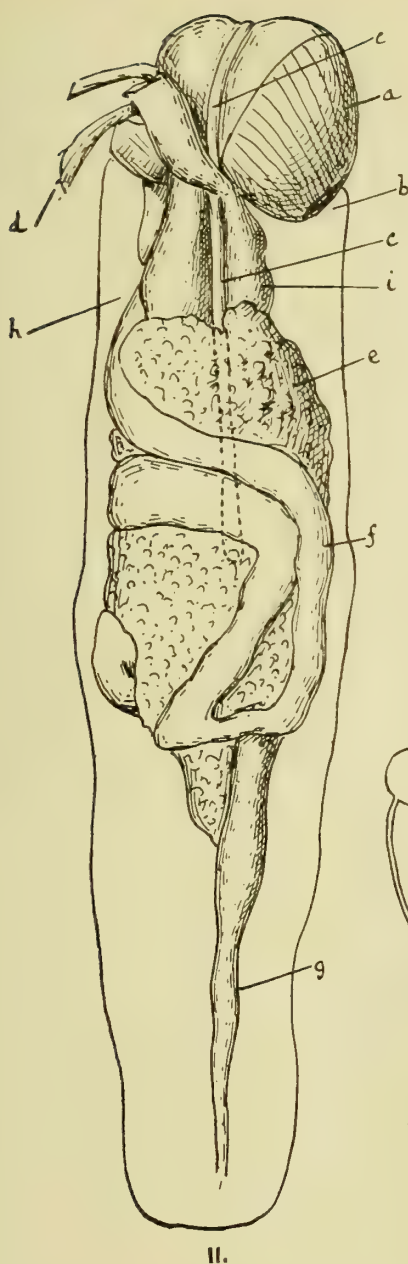
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#### *Explanation of Figures.*

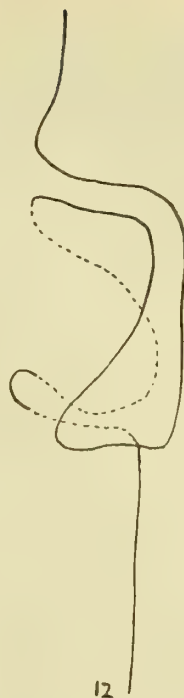
Fig. 11.—Digestive apparatus before dissection. The genital and renal organs are raised, as well as the heart. In the foreground the oesophagus has been pushed to the left so that the bulb may be seen. Towards the back the radular sac, hidden by the liver, is represented by dots. a—bulb, b—visible part of right cartilage, c—radular sac, d—strips belonging to the muscles attached to the anterior valve, e—liver, f—intestine, g—rectum, h—oesophagus, i—papillary sac. Magnification: 25.

Fig. 12.—Plan indicating the course of the intestine; the dotted parts are those which are hidden in Fig. 11.

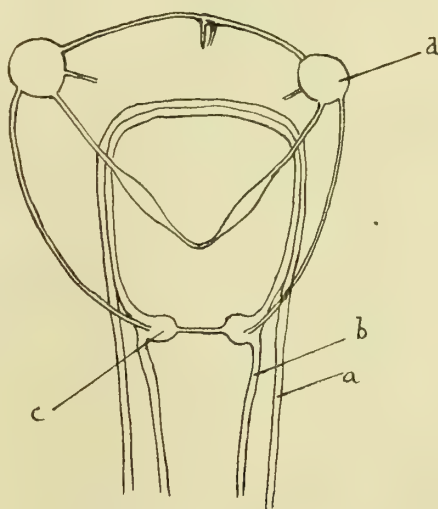
Fig. 13.—Central nervous system. a—cerebro-palleal cord, b—pedal cord, c—post-oesophageal ganglia.



11.



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13

ISCHNOCHITON ACOMPHUS.  
Figs. 11 to 13.

closely coupled to the valves. The glands remain attached to these valves when the latter are removed. A large mass is then found, consisting of the digestive canal, with extensive circumvolutions, and of the liver. The buccal bulb is found hidden in front by a great number of muscular tracts which are attached to the anterior valve.

*Digestive apparatus.* Fig. 11 shows the whole of the digestive tube in its natural position. The bulb is very large, and of a dark red colour. The cartilages show at the lower part, having the appearance of an ivory coloured region, spotted with black at the point where the muscles which end laterally at the radular sac diverge. The radular sac is greatly developed; its extension is indicated by dotted lines in Fig. 11, the posterior portion being hidden by the liver and intestine. Below the rotella, behind the mouth, the sub-radular organ is found in the form of two slight projections, facing the upper plane, coupled as shown in Fig. 4. The oesophagus, very soft at the side, covers the bulb, and the radular sac in front. It contains the two papillary sacs furnished with numerous closely packed papillae. These papillae, greatly developed, are simple, at the side indented only, not branched (Fig. 7). The radula shows from 40 to 45 completely developed rows. The central tooth is very variable. Examined under the microscope alone its form is difficult to interpret. The base widens behind in lozenge form, narrowing in front, until it rises in a median crest which projects in a slightly hooked cusp. Fig. 9 shows the central tooth viewed laterally. The first lateral shows at its outer margin a slightly projecting ledge. The second lateral is greatly developed. It shows two very strong rounded cusps, coloured dark yellowish-brown, nearly black on the free edge; the colour becomes lighter towards the base of the tooth. Fig. 8 gives one of the aspects which the second lateral can present. Beyond the third lateral the projecting palette comes; its terminal enlargement is shown in Fig. 10. It will be seen that the axis becomes narrower as it extends. The other teeth do not present any special character; their shape is indicated in Fig. 15.

The oesophagus, behind the bulb, and at the outlet of the papillary sacs, presents the most interesting arrangement of the system. It widens into a flattened pocket (stomach) passing beneath the radular sac. Fig. 6 shows this in its natural position. Fig. 5, on the other hand, shows the stomach drawn back beneath the radular sac, viewed laterally. The wall of this stomach is very thin and transparent. The intestine which proceeds from it describes convolutions embedded in the lobes of the liver. This relatively simple survey is indicated in diagram 12 annexed to Fig. 11. The rectum is rectilinear, and its diameter diminishes progressively towards the anus.

*Nervous system.* The two cerebro-palleal and pedal cords are coupled in front of the mouth. They diverge only when the pedal cords meet the two ganglia, situated immediately behind the buccal orifice. These ganglia are joined by a commissure. The ganglion masses situated behind the mouth divide to right and left into a long coupling which terminates in the ganglion lying at the opening of the oesophagus on the bulb. These ganglia, which are spherical, are far removed from the cerebro-palleal and pedal cords. They divide in front of the nerves which anastomose in front

#### *Explanation of Figures.*

Fig. 14.—Plan showing the correspondence between the nervous system and the digestive apparatus. a—oesophagus, b—bulb, c—radular sac.

Fig. 15.—Half row of radular teeth. Magnification: 400.

Fig. 16.—Heart.





ISCHNOCHITON ACOMPHUS.  
Figs. 14 to 16.

of the oesophagus and behind the couplings which meet again, so that a complete nervous ring surrounds the oesophagus at this level. The posterior couplings each carry a fusiform swelling.

*Reproductive apparatus.* The genital gland is white in the male, yellowish in the female. The posterior part of the female gland is shown in Fig. 17. The posterior point is situated immediately behind and above the rectum.

*Circulatory system.* The form of the heart is outlined in Fig. 16.

(c). *Reproduction.*

It has been possible to observe the laying of eggs in a glass vessel filled with sea-water which makes direct observation under a binocular microscope possible. An *Ischnochiton* collected on March 15th, 1930, laid on March 17th, that is to say, three days after the full moon of March 14th. Before this larvae had been obtained without observation of the egg-laying, specimens had been collected at full and at new moon tides, and the egg-laying must have taken place at the same time. It is owing to the times of spring tides being most convenient for research that the common belief has arisen that *Loricates* normally lay their eggs at full moon. General application should not be made too readily from these observations, as the result of the preceding observation indicates.

In order to lay its eggs, the *Ischnochiton* raises the posterior part of its girdle in an arc. It moves from time to time during the extrusion. The ventral surface of the animal was observed through the side of the glass. It was close to the surface of the water. The emission of the eggs is fairly rapid, about one per second, but irregular, two or three eggs sometimes being extruded at the same time. As the light fell on the dorsal surface of the animal, one could see by the transparency, the eggs being extruded to the right and to the left of the edge of the foot. They began to emerge fairly slowly, and were then suddenly propelled abruptly to a distance of about 4 millimetres. The position of the female being given, the majority of the eggs fell to the bottom of the glass vessel, but some remained attached to the side of the glass or to the girdle.

The eggs are visible to the naked eye like a fine dust. They are yellow in colour and the egg-mass is quite opaque. They are surrounded by a transparent envelope and furnished with a great number of papillae, which give them the appearance of little sea-urchins (Fig. 21). The papillae are planted one beside the other in a regular manner following the circles on the sphere in parallel planes (Fig. 22). The flexible papillae carry at their extremity four hooks directed towards the bulk of the egg. The following results were obtained when an egg was measured: diameter of egg  $196\ \mu$ ,

*Explanation of Figures.*

Fig. 17.—Posterior part of the genital gland.

Fig. 18.—Young larva at time of hatching. a—eye, b—boundaries of valves in formation, c—surface carrying tubercles in formation, d—ciliated furrow. Magnification: 250.

Fig. 19.—Larva one day after hatching. a—zone furnished with papillae (girdle). Magnification: 270.

Fig. 20.—Larva two days after hatching. Magnification: 270.

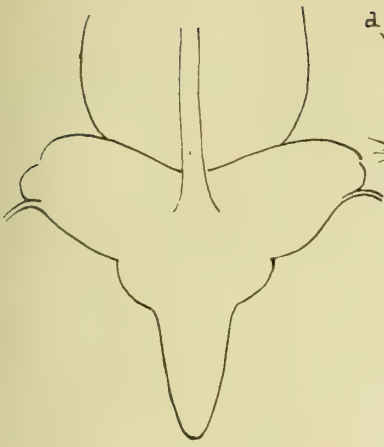
Fig. 21.—Egg. Magnification: 160.

Fig. 22.—Plan showing regularity of insertion of papillae on the shell of the egg.

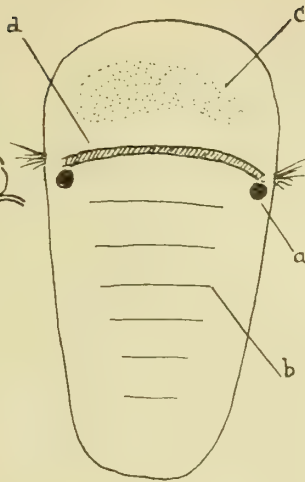
Fig. 23.—View of enlarged tubercles of larva two days after hatching.

Fig. 24.—Extremity of papillae on the shell of the egg. Magnification: 6,000.

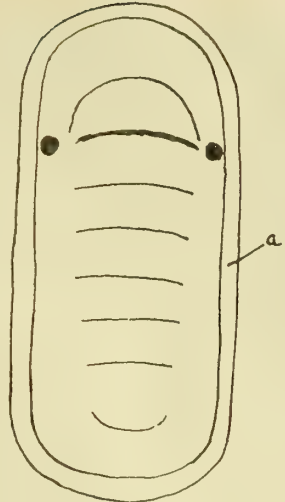
Fig. 25.—A papilla. Magnification: 1,000.



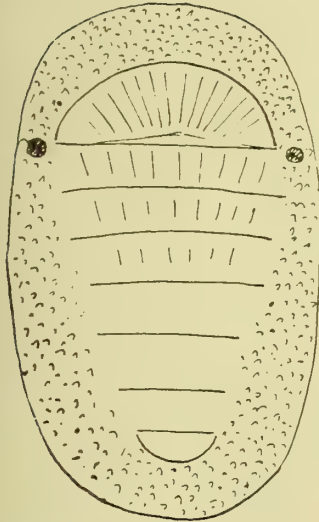
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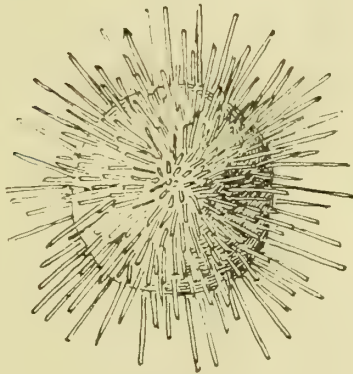
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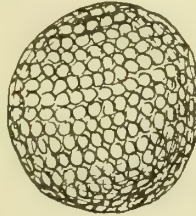
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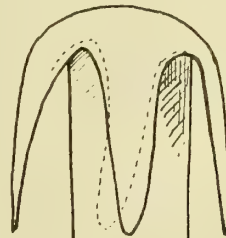
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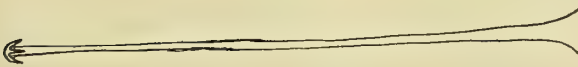
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23.



24.



25

ISCHNOCHITON ACOMPHUS.  
Figs. 17 to 24.

length of a spine (all of equal height)  $84\ \mu$ , length of hooks of spine  $5\ \mu$ . These hooks enable the eggs to attach themselves to surrounding bodies.

Among the eggs extruded a certain number preserved their yellow, slightly greenish, coloration, and succeeded in developing. A considerable number of the others (doubtless under the influence of bacterial infection) took on a beautiful bright red coloration, and afterwards underwent decomposition.

Development is extremely rapid. On March 20th the hatching of an egg was observed. The larva completely fills the egg-shell and distorts it by its contraction. The split shell is then abandoned (it remains transparent and with its papillae intact). As soon as the larva is free it crawls rapidly. Fig. 11 shows the course of hatching. The body is divided into two parts by a deep furrow which shows in contrast by its deep green colour. The deep reddish eyes are clearly visible at the extremities of and a little behind the furrow. Behind the furrow six faint lines indicate the divisions between the valves in formation. The rear-most of these lines seems to correspond to the posterior part of the last valve. The girdle is already indicated by spiny projections, which are already marked, above all, on the posterior half of the furrow. At the point where the furrow meets the circumference of the body, one may easily see the very active ciliary projections constantly moving. All the anterior part of the body shows on its circumference the movement of tiny ciliary projections. These, which are visible only at the periphery, extend, no doubt, over the whole surface of the furrow. The boundaries of this deep green furrow are a little irregular. It is closely covered with ciliary projections over all its surface. In front of it numerous tubercles are seen forming, but at a certain distance from its anterior edge, in a zone indicated by dotted lines in Fig. 18. This is the anterior zone of the girdle. The zone is asymmetrical, as indicated by the figure. A day later, the larva presented the aspect indicated by Fig. 19. The eyes were a little less clear and relatively diminished. The girdle was provided with transparent papillae over a little width. The foot was as wide as the whole of the body with its girdle, and was very thick. The length of the larva was then  $285\ \mu$ . Observations made on the valves, compared with those of the previous day, were rather disconcerting; only seven valves were to be seen. One of these, being placed in the position of the eyes, seemed to be formed in the anterior zone of the furrow, its posterior limit being also more clearly defined than those of the other valves. It might be thought that the six furrows of the larva at the preceding stage, also weakly defined, did not correspond to the intervals between the successive valves, but that the last furrow marked the posterior margin of the last valve.

The larva aged five days (from date of extrusion of egg) is shown in Fig. 20. The eight valves are developed. The first is very wide, the others progressively narrower, the last being greatly reduced. On the girdle are large papillae, of which a greatly magnified view is given in Fig. 23. The first valves show the beginning of their sculpture, the furrows thus formed becoming weaker towards the rear. The eyes are visible by means of the transparency, but are actually situated on the edge of the foot (they may sometimes be seen on the foot exposed beyond the girdle). From this moment the larva possesses most of the characteristics of the adult.

(The position of the eyes in the larva is not always the same. In a larva of four days, observed on August 27th, the left eye was shown situated much farther back than the right eye, this latter being in the usual position; the left eye was placed a little towards the anterior half of the body),

(To be continued.)



# NOTES ON LORICATES (CHITONS) COLLECTED ON THE COAST OF QUEENSLAND IN 1928, 1929 AND 1930.

By JOHN S. MACKAY, M.D., Melbourne.

## *Tidal Variation.*

A preliminary note on the tides may be of interest. Most people are aware that the tides are recorded, according to the amplitude of rise and fall, those of greatest amplitude being termed Spring Tides and the smallest Neap Tides. Spring Tides occur at New and Full Moon.

On the Queensland coast there is marked seasonable variation. During the summer months the Full Moon day tides are in excess of the New Moon day tides. This applies to the months of November to May inclusive. From June to October the reverse occurs, the New Moon day tides being the greater.

Moreover, the winter tides show a much greater swing than the summer ones. For instance, in the summer of 1929-30 the lowest day tide registered five inches above the fixed tidal survey mark, whereas the lowest winter tide for 1929 went two inches below it, and the lowest for 1930 is calculated to go six inches below.

For brevity and convenience these figures are represented throughout this article as plus and minus, e.g., + 5 and — 2.

It will be seen that the winter months from June to October are the most favourable for collecting.

The hour of low water on any given date varies considerably at different parts of the coast, and it is necessary to have a copy of Tide Tables for reference. Such tables are obtainable in pamphlet form from the Department of Harbours and Marine, Brisbane. Corrections are given for fixed points up the Queensland coast, and it becomes a simple matter to forecast the time of low water and extent of fall.

*Note.* The foregoing remarks apply to day tides only. Actually, the lowest tide for the year 1929 occurred in November, at Full Moon, and reached the exceptional summer mark of — 5. As the time of low water was between 3 and 4 a.m., shelling was impracticable, and night tides have accordingly been omitted.

## *The Peronian and Solanderian Regions.*

The Queensland coast offers a special interest to Loricata collectors. In Southern Queensland we find representatives of the Peronian Area, which extends from Wilson's Promontory, in Victoria, up the coast of New South Wales.

It was suggested by Hedley (1) that the northern limit of this area lay in Moreton Bay, Queensland. From here north he described the tropical Solanderian Area, merging at Torres Strait into the Dampierian Region from Houtman's Abrolhos, West Australia.

Later writers (2 & 3) showed that the shells of the Solanderian and Dampierian Zones were identical. The two have accordingly been merged into one as the Solanderian-Dampierian, or, more simply, the Solanderian. It is in this last extended sense that the word "Solanderian" is used in this article.

Ashby (4) thought that the Peronian Area might extend as far north as Keppel Bay.

Further reference will be made later to the Junction of the Peronian and Solanderian Areas, and it will be seen that it lies between the limits mentioned above.

*Localities Visited and Species Taken.*

The following places were visited:—

1. In the *Peronian Area*. Burleigh Heads, Caloundra, Point Cartwright, Alexandra Head and Coolumb.
2. In the *Solanderian Area*. Pinalba, Port Curtis (Gladstone), Keppel Bay (including Emu Park, Pelican Id., Wedge Id. and South Keppel Id.), Broad Sound (St. Lawrence), Bowen (Queen's Beach), Townsville (Kissing Point), Magnetic Id., Palm Island Group (Palm and Fantome Ids.), and Mourilyan Harbour (Robinson's Beach).

The area studied embraced over ten degrees of latitude, from 28 deg. 0 min. S. to 17 deg. 40 min. S. The actual coastline over this distance exceeds 1,200 miles.

Each locality may be considered in detail.

## PERONIAN AREA.

A. *Burleigh Heads.*

Burleigh Heads lies about ten miles north of the New South Wales border. Geologically, the headland consists of tall hexagonal columns of black basalt. At the base lies debris of broken columns, fragmented and weathered by action of the sea. Odd pieces of quartz and quartzite may be found. It is rather exposed, but two relatively sheltered large pools offer themselves for exploration on the most northerly part.

The following 9 genera, 9 species were taken:—

*Ischnochiton crispus* Reeve; *Haploplax smaragdina* Angas; *Callistelasma antiqua* Reeve; *Acanthochiton granostratus* Pilsbry; *Meturoplax retrojecta* Pilsbry; *Craspedoplox variabilis* H. Adams & Angas; *Poneroplax paeteliana* Thiele; *Liolophura queenslandica* Pilsbry; *Onithochiton quercinus* Gould.

*Remarks.* Burleigh Heads offers an interesting field for investigation. The northerly limits of many members of the Peronian Zone are as yet undetermined. Although several months were spent here the tides and weather were both unfavourable, and search under more favourable conditions might easily add to the nine genera and species taken here.

The most notable find was *Ischnochiton crispus*, the first record of this shell in Queensland waters.

Three genera of Acanthochitonids were found. Of these *Craspedoplox variabilis* is exceedingly common. Iredale and Hull separate the sub-species *C. variabilis cambrica* and *C. variabilis diminuta*. The writer, whilst recognising that the Queensland shells are much smaller than those from Victoria and South Australia, prefers for the present to record the shell under the general name *C. variabilis*.

B. *Caloundra.*

This seaside resort lies about 60 miles north of Brisbane and may be approached by motor, rail and motor, or bay steamer and launch. There are two sandstone headlands of which the more northerly (Moffat's Head) proved the better.

Caloundra was visited in July, 1928, and April, 1929. On each occasion the tides were poor (best tide + 7) and the weather unfavourable. In spite of this many specimens were taken. To the north of the most prominent part of Moffat's Head lies a sheltered cove, with large flat slabs of sandstone and many smaller fragments, all more or less overgrown with seaweed.

14 genera, 15 species were taken.

*Ischnochiton examinandus laetior* Hull; *Heterozona fruticosa* Gould;

*Ischnoradsia australis* Sowerby, var. *divaricata* Hull; *Haploplax smaragdina* Angas; *Terenochiton badius* Hedley & Hull; *Terenochiton liratellus* Iredale & Hull; *Paricoplox crocina* Reeve\*; *Callistelasma antiqua* Reeve; *Notoplox gabrieli* Ashby; *Craspedoplox variabilis* H. Adams & Angas; *Delicatoplox translucens* Hedley & Hull; *Rhyssoplox vauchusensis* Hedley & Hull; *Mucrosquama particolor* Hull; *Liolophura queenslandica* Pilsbry; *Onithochiton quercinus* Gould.

Remarks. *Heterozona fruticosa* and *Ischnoradsia australis* are common.

*Callistelasma antiqua* and *Liolophura queenslandica* are also common. *Haploplax smaragdina* was plentiful at the first visit, but rather scarce at the second owing to rough weather. Six *Ischnochiton examinandus laetior* were taken by two workers in a week; also six *Delicatoplox translucens*, 10 *Rhyssoplox vauchusensis* and two *Mucrosquama particolor*.

Only one *Paricoplox crocina* was taken in two visits.

In discussing this shell, Iredale and Hull (5) remark:—

"When alive this shell is covered with a glutinous epidermis, which appears to contain the fugitive protective colours."

This statement is open to question. The writer noted that worn beach valves were brightly coloured. It is evident that the epidermis does not contain the colour, but conceals it. In life the epidermis, being semi-transparent, permits the coloration of the valves to show. At death it coagulates and becomes opaque, giving a dull appearance to the shell. If the epidermis be removed, e.g., by the action of caustic soda, the original colours return with added brilliancy.\*\*

Acanthochitons were represented by *Craspedoplox variabilis* and *Notoplox gabrieli*, neither being rare. Ashby's original description (6) of the latter shell is not very precise. He mentions "deep broken longitudinal grooving in the dorsal area" and two pages on, possibly referring to this species, he uses the words "short longitudinal rows of shallow holes."

Iredale and Hull (7) say "pitting of the dorsal area."

The writer, from an examination of a series at different stages, is of opinion that this feature is really sculpture of low convex pustules, i.e., raised and not "pitted."

The station of *Notoplox gabrieli* appears to be at low water, under stones cemented together by sand and calcareous debris. *Callistelasma antiqua* is found in the same situation.

In lifting the stones care should be taken, unless wearing gloves, not to allow the hands to come in contact with the stinging worm (POLYCHAETA—? *Chloëia flava pallas*).

Although there are no immediate ill-effects, the irritation caused by the penetration of the minute hair-like processes with which it is fringed may last some weeks.

*Terenochiton liratellus* was found, as a rule, on small stones, deeply

\*This shell was formerly erroneously identified as *Levicoplox* (*Chiton*) *platessa* Gould.

\*\*Iredale and Hull maintain their opinion. In no case does the brilliant combination of green, purple and red so often found on the live shell continue through to the tegmentum, although a deep red is found sometimes where the epidermis has been eroded, while the remaining portion of the epidermis is principally of the other colours. Dead valves are frequently found wholly red in colour. (Ed.).

recessed under the overhanging slabs. *Terenochiton badius* was taken in similar positions, but buried in mud. The series of *Terenochitons* secured here and at Point Cartwright gives the writer the opportunity of confirming an observation by Ashby which has received insufficient recognition.

Ashby (8) wrote of *Lepidopleurus (Terenochiton) liratus* H. Adams and Angus:—

"The girdle is clothed with flat, elongate, imbricating scales, mostly straight sided and considerably longer than broad, which are very easily detached. From amongst these scales proceed, chiefly near the shell, long, white, cylindrical spicules, which are about four times the length of the scales; these spicules are in clusters at the sutures, elsewhere more or less scattered. The girdle is also furnished with a spiculose fringe. . . ."

When Iredale wrote his original description of *Terenochiton* (9) *T. subtropicalis*, the material available was limited. At the request of the writer he recently re-examined paratypes and was unable to detect any sutural tufts.

The writer, in examining his series of *T. liratellus* and *T. badius*, found that scanty sutural tufts were constantly present. These tufts, which commonly consist of three or four long, curved, glassy, pointed spicules arise from the suture line close to the valves. They appear to be extremely brittle and, therefore, liable to become broken or detached. They are in no way to be confused with the spiculose edge of the girdle, which is quite distinct.

Apart from these sutural tufts, a few spicules were observed elsewhere on the girdle. These observations were confirmed by examination of other *Terenochitons* in the writer's possession, including *Terenochiton badius*, *T. matthewsianus*, *T. liratus*, *T. liratellus* and *T. (Lepidopleurus) glauerti*.

#### C. Point Cartwright.

Some ten miles to the north of Caloundra is Point Cartwright. It lies at the mouth of the Mooloolah River, forming the south head. It is not easy of access, but may be reached by car to Mooloolabah, via Maroochydore. Boats may be hired to traverse the mile or so of river to its entrance into the sea. Point Cartwright consists of a high sandstone headland, with a wide weathered sandstone shelf breaking into slabs and fragments. The best part for collecting was found to be the most northerly portion of the headland close to where the river enters the sea. Here the conditions were similar to those at Caloundra, there being weed-covered slabs of sandstone with numerous sheltered pools.

Point Cartwright was visited on May 7th and 9th, 1929. On the better of these days the tide level was given in the Tables as + 2, but a fresh south-easterly breeze probably did not allow it to recede so far. The tide conditions were thus not particularly good.

15 genera, 16 species were taken.

*Ischnochiton examinandus laetior* Hull; *Heterozona fruticosa* Gould; *Ischnoradsia australis* Sowerby, var. *divaricata* Hull; *Haploplax smaragdina* Angus; *Terenochiton badius* Hedley & Hull; *Terenochiton liratellus* Iredale & Hull; *Callistelasma antiqua* Reeve; *Loricella angasi* H. Adams; *Notoplax gabrieli* Ashby; *Craspedoplax variabilis* H. Adams & Angus; *Poneroplax paeteliana* Thiele; *Delicatoplax translucens* Hedley & Hull; *Rhyssoplax vauchusensis* Hedley & Hull; *Mucrosquama particolor* Hull; *Liolophura queenslandica* Pilsbry; *Onithochiton quercinus* Gould.

*Remarks.* The Loricata fauna is practically identical with that found at Caloundra. *Paricoplax crocina* was not taken here, but, on the other hand, *Poneroplax paeteliana* and *Loricella angasi* were added.



There is no previous record of *Poneroplax* being taken in Moreton Bay. There is some uncertainty about the status of species in this genus. Ashby (10) recorded two specimens from Burleigh Heads, which he considered conspecific with *P. tasmanica* Thiele. Adult specimens of *Poneroplax* from their exposed station usually show marked erosion, and this renders their positive identification difficult unless juveniles can be secured. The series taken by the writer at Burleigh Heads, Point Cartwright and Coolum, showed enough sculpture to identify them as conspecific with *P. paeteliana* Thiele.

The type locality of *Loricella angasi* H. Adams, is given as Rapid Bay, South Australia. The New South Wales shells have been separated by Ashby (11) under the name of *Loricella torri*, the distinguishing feature being the presence of "Spear Head" processes in the girdle of the South Australian form and their absence in the New South Wales shells. The examples taken at Point Cartwright were juvenile and showed no such processes, so that, if the two species are separable, these specimens will bear the name *L. torri* Ashby. Hitherto no *Loricella* has been recorded north of Port Stephens, N.S.W., and its discovery nearly 500 miles further north is of exceptional interest. Two specimens were taken, the situation being under large sandstone blocks below low water level.

#### D. Alexandra Head.

This headland was passed on the way to Point Cartwright, and lies about two miles north of it. A brief visit was paid during a moderate tide (+ 4) in rough weather, and, although the general conditions seemed favourable, no Loricates were taken.

#### E. Coolum.

Coolum Beach is about half-way between Point Cartwright and Noosa Head, and may be reached by cane tramway or by road. It is about ten miles from Yandina, the nearest railway station.

The writer cannot improve on Hull's description (12), "Grano-diorite and schists—extremely hard and jagged masses, seamed and riven with deep clefts into which the surf tumbles violently, even in moderate weather."

On the occasion of our visit both tides (+ 8) and wind (S.E.) proved unfavourable.

12 genera, 12 species were taken.

*Ischnochiton examinandus laetior* Hull; *Heterozona fruticosa* Gould; *Ischnoradsia australis* Sowerby, var. *divaricata* Hull; *Haploplax smaragdina* Angas; *Terenochiton liratellus* Iredale & Hull; *Callistelasma antiqua* Reeve; *Notoplax gabrieli* Ashby; *Craspedoplax variabilis* H. Adams & Angas; *Poneroplax paeteliana* Thiele; *Delicatoplax translucens* Hedley & Hull; *Liolophura queenslandica* Pilsbry; *Onithochiton quercinus* Gould.

**Remarks.** Most of these were taken from one pool of moderate size. *Terenochiton liratellus* and *Delicatoplax translucens* were represented by single individuals. The list is almost identical with that of specimens taken at Point Cartwright. It is evident that Coolum is in the Peronian Area. It lies in latitude 26 deg. 30 min. S. approx.

#### SOLANDERIAN AREA.

##### A. Pialba.

Pialba lies at the southern extremity of Hervey Bay, in latitude 25 deg. 16 min. S. approx. Geologically, the coast is of Burrum formation, thin superimposed sheets of weathered sandstone. The coastline here runs in a sweeping curve to the north-west. On the eastern boundary of Hervey

Bay lies Great Sandy or Fraser Island, which runs approximately north by east. There is thus enclosed on all sides except the north a large sheltered bay over 40 miles in width.

The surge of the open sea gives way to placid sheltered waters. Instead of abrupt sandy beaches passing quickly into deep water, a foreshore extends at low tide for over half a mile. With these shallow waters we get the associated mud and mangrove. For the first time on the way north live coral appears, whilst dead "nigger-heads" abound.

It was evident that we had entered on a new set of conditions, and this fact soon received confirmation in the Loricata fauna.

Our visit was made from May 22nd to 24th inclusive, 1929. The weather was fine, but the tides poor (+ 7).

4 genera, 5 species were taken.

*Ischnochiton examinandus laetior* Hull; *Ischnochiton distigmatus* Hull; *Callistelasma periousia* Iredale & Hull; *Rhyssoplax venusta* Hull; *Liolophura queenslandica* Pilsbry.

*Remarks.* The common *Ischnoradsia australis* and *Heterozona fruticosa* are no longer in evidence. *Callistelasma antiqua* is replaced by *C. periousia*, a species easily separable. The striking *Haploplax smaragdina*, *Rhyssoplax vauchusensis* and *Delicatoplax translucens* disappear, and the new *Rhyssoplax venusta* takes the field in considerable numbers. For example, 54 *R. venusta* were taken in three days. *Ischnochiton examinandus laetior* from being uncommon becomes relatively plentiful, 22 being taken. The rare *Ischnochiton distigmatus* found by Hull near Bowen puts in an appearance, two specimens being taken under stones buried in mud at low water.

A note on the relationship of this species to *Ischnochiton luticolens* Hull, will be found at the end of these notes.

The fact that a new faunal zone had been entered could hardly have been more forcibly demonstrated.

From Pialba to Coolumb, in a straight line, would be about 45 miles. In between these two places lie Noosa Head, Double Island Point, Inskip Point, Hook Point and the shores of Great Sandy Island. Apart from a fruitless visit paid by Hull in 1921 to Noosa Head, the writer knows of no record of search for Loricata having been made in this area.

The writer suspects that the actual boundary is sharply defined and dependent on geographical considerations. In this connection the northern extremity of Great Sandy Island is suggestive. The eastern coast is open ocean, and the water temperature would be similar to that on the coast-line a few miles south.

The comparatively shallow waters of Hervey Bay are largely encircled by land and are noticeably warmer to the touch. Moreover, at this point on the coast, the Great Barrier Reef begins to exert its sheltering influence.

Further investigation is needed of this intervening area.

#### B. Port Curtis.

The only part of this magnificent harbour visited was in the immediate vicinity of Gladstone. Tide + 4.

4 genera, 4 species were taken.

*Ischnochiton luticolens* Hull; *Haploplax arbutum* Reeve; *Callistelasma periousia* Iredale & Hull; *Squamopleura curtisiana* Smith.

*Remarks.* *Squamopleura curtisiana* abounds amongst oysters on stone approaches of a jetty. The other three were taken from fragments of quartzite, embedded in the unlovely mud of Barney Point.

### C. Keppel Bay.

Headquarters were made at Emu Park, whence the adjacent foreshores and neighbouring islands were visited. There are over a dozen islands visible from Emu Park. The rocks are for the most part quartzite and schist, but the geological formation is not simple and basalt and conglomerate occur in places. Conditions for Loricates are ideal. The numerous outcrops of reefs offer every variety of shelter and food. In August, 1928, a week was spent here, and in 1929 the part or whole of June, August, September and October.

Visits were paid to Pelican Id. (2), Wedge Id., and South Keppel Id. As the Loricata fauna on these islands is almost identical with that of the adjacent mainland, it is convenient to group the list of Loricates taken under the general heading of Keppel Bay.

14 genera, 17 species were taken in Keppel Bay.

*Ischnochiton examinandus laetior* Hull; *Ischnochiton luticolens* Hull; *Heterozona fruticosa* Gould; *Haploplax arbutum* Reeve; *Terenochiton liratellus* Iredale & Hull; *Callistelasma periousia* Iredale & Hull; *Acanthochiton granostriatus* Pilsbry; *Acanthochiton complanatus* Hull; *Acanthochiton pelicanensis* Mackay; *Meturoplax retrojecta* Pilsbry; *Craspedoplox variabilis* H. Adams & Angas; *Rhyssoplax venusta* Hull; *Squamopleura curtisiana* Smith; *Liolophura queenslandica* Pilsbry; *Acanthozostera gemmata* Blainville; *Onithochiton quercinus* Gould; *Lucilina shirleyi* Iredale.

—Remarks. *Ischnochiton examinandus laetior* was taken in some numbers. It exhibits great beauty and delicacy of colouring. It may here be remarked that certain localities seemed to show more or less consistent colour variation in this species. For example, shells from Emu Park were delicately tinted and splashed with shades of yellow, orange, pink or purple, mostly on a white background. From South Keppel Id. green markings on a white background predominated. At Mourilyan, near Innisfail (vide infra), examples were almost uniformly a rich brown with whitish markings. Substantial series (Emu Park 80 examples, South Keppel 42, Mourilyan 30) were taken, so that the colouring seems to be fairly well fixed for these localities.

*Ischnochiton luticolens* is less plentiful here than it becomes further up the coast, but 20 examples were secured.

*Rhyssoplax venusta* is not uncommon. In 1929, 61 were taken, showing a fine colour series. The range and depth of colour is more marked here than at Pinalba. Mention may be made here of the observed preference of members of the genus *Rhyssoplax* for the sides of stones to the under surface. This had been noted by the writer in such diverse representatives as *R. tricoloris*, *R. orukta*, *R. diaphora* and *R. calliozona* in Victoria, *R. jugosa* in New South Wales and *R. vauchusensis* and *R. venusta* in Queensland. The long series of *R. venusta* taken allowed confirmation of what had been noted in the southern shells. At Emu Park, the flat-sided prisms of quartzite offer smooth surfaces, with an upper inclined face, and this was found to be a favourite situation. Moreover, most specimens were taken above neap low tide level and below half tide. They are commonly found just buried in sand in shallow pools.

The solitary example of *Heterozona fruticosa* found is noteworthy. This Peronian shell had not been hitherto recorded north of Coolum. One full-grown example was collected by the writer in August, 1928, on the point near the jetty at Emu Park.

In a pool nearby was taken in 1929 a single specimen of *Terenochiton liratellus*. In each of the two last mentioned species the discovery extends the known range by about 300 miles.



*Haploplax arbutum* is present in great variety of colouring. Its station is rather high in the littoral zone, as is usual with most members of this genus. It prefers muddy situations, a taste it shares with *Ischnochiton laticolens*. A favourite site was found to be the high level pools on the sheltered side of the rocky point near the stone jetty.

Acanthochitons are somewhat puzzling. Representatives were fairly numerous in August, 1928, exceedingly rare in June, 1929, and common in September-October, 1929. One *Acanthochiton granostriatus* was taken. *Acanthochiton complanatus* was found at South Keppel Id., and not elsewhere in Keppel Bay. It was taken on the sides of stones, partly embedded in clean sand on an open beach well above low tide level. Associated with it on the same stones was *Lucilina shirleyi*, which also was not taken elsewhere.

*Acanthochiton pelicanensis* was a new species taken by the writer at Pelican Id. in 1928, and published in 1929 (13). It speaks volumes for Mr. A. F. Basset Hull's assiduity as a collector that two subsequent prolonged visits by the writer should have failed to add anything more than this small shell. Careful search in Keppel Bay in 1929 failed to rediscover it, but later a solitary specimen was found at Magnetic Id., some 400 miles north of the type locality. Although rare, it is evidently of wide range.

*Metuopanax retrojecta* was found both in the form described by Pilsbry and in the variety *pustulosus* Ashby. The extremes are far apart and would justify specific separation but for the existence of intermediate forms which would doubtfully fall into either.

*Craspedopanax variabilis* became very common in October, 1929.

*Squamopleura curtisiana* was represented by one small individual from Pelican Id.

*Liolophura queenslandica* is abundant throughout the whole length of the Queensland coast as far north as the writer has collected.

A number of specimens of *Acanthozostera gemmata* were collected for the writer at Wreck Id. by Mr. C. Morris, of Emu Park. All were greatly eroded.

*Onithochiton quercinus* is abundant in Keppel Bay. Although a few specimens were taken at medium tide level, it is found in greatest abundance below lowest tide limits. Some examples show great brilliancy of colouring.

#### D. Broad Sound.

St. Lawrence, at the head of Broad Sound, lies rather over 100 miles north of Rockhampton. Broad Sound is chiefly remarkable for its phenomenal tides, which are said to reach the great height of 38 feet at their maximum. Such an excessive rise and fall is not favourable to Loricates. The only collecting done was on a reef some ten miles north of St. Lawrence where we took.

1 genus, 1 species.

*Squamopleura curtisiana* Smith.

Remark. Only a cursory examination at half tide was possible.

#### E. Bowen.

A brief visit limited to two hours was paid to Queen's Beach in August, 1928. Tide + 16.

5 genera, 5 species were taken.

*Ischnochiton laticolens* Hull; *Haploplax arbutum* Reeve; *Callistelasma periousia* Iredale & Hull; *Craspedopanax variabilis* H. Adams & Angas; *Liolophura queenslandica* Pilsbry.

#### F. Townsville.

The extensive sand and mud flats in the vicinity of the town do not



offer a promising field for Loricates. Kissing Point (granite) was visited and a few Loricates taken.

4 genera, 4 species.

*Ischnochiton luticolens* Hull; *Haploplax arbutum* Reeve; *Craspedoplax variabilis* H. Adams & Angas; *Liolophura queenslandica* Pilsbry.

Remark. Tide + 19.

#### G. Magnetic Island.

The 1928 visit to this granite island was limited to a few hours at Horseshoe Bay, the tide being + 8. In August, 1929, about ten days were spent at Picnic Bay. The best tide was — 2, and the weather for the most part favourable.

12 genera, 15 species were taken.

*Ischnochiton examinandus laetior* Hull (?); *Ischnochiton luticolens* Hull; *Haploplax adelaidensis* Reeve; *Haploplax arbutum* Reeve; *Callistelasma periousia* Iredale & Hull; *Acanthochiton granostriatus* Pilsbry; *Acanthochiton pelicanensis* Mackay; *Craspedoplax variabilis* H. Adams & Angas; *Aerilamma primordia* Hull; *Rhyssoplax venusta* Hull; *Squamopleura curtisiana* Smith; *Liolophura queenslandica* Pilsbry; *Acanthozostera gemmata* Blainville; *Onithochiton quercinus* Gould; *Lucilina fortilirata* Reeve.

Remarks. Shelling was mostly done in the vicinity of Picnic Bay, a sheltered beach of coarse granite gravel and coral debris, shelving down to a mud flat with much coral, which is only exposed at the lowest tides. Granite boulders form the flanks, and the eroded skeleton of a steel ship covered with oysters lies near the eastern end. Many bottles littered the bay and went far to compensate for the scarcity of loose stones.

As *Ischnochiton examinandus laetior* was found only in juvenile form, the recording of this species must be accepted with reservation for the present.

*Ischnochiton luticolens* and *Haploplax arbutum* are common, especially on bottles.

Two specimens of *Haploplax adelaidensis* were taken at the west end of Nellie Bay.

A single specimen of the rare *Acanthochiton pelicanensis* was taken from live *Pinna* in Picnic Bay.

*Aerilamma primordia* was present in some numbers, 24 being taken on weed encrusted boulders at the west end of Nellie Bay.

Two specimens of *Onithochiton quercinus* were taken in Picnic Bay. Previous records of this shell identify it as far north as Mackay, with a queried reference to Raines Id., Torres Strait. This discovery definitely takes it 200 miles north of Mackay, and increases the likelihood of the Raines Id. locality being correct.

*Lucilina fortilirata* was taken on bottles and loose stones. A number were found on dead oyster shell adherent to granite boulders, not much below neap tide high water mark. It is unusual for this shell to be emergent.

#### H. Palm Group (Palm and Fantome Islands).

Palm and Fantome Islands were visited in September, 1928. Four days were spent there. Tides + 1.

10 genera, 13 species were taken.

*Ischnochiton luticolens* Hull; *Haploplax arbutum* Reeve; *Callistelasma periousia* Iredale & Hull; *Callistelasma generos* Iredale & Hull; *Lophochiton granifer* Hull; *Acanthochiton granostriatus* Pilsbry; *Acanthochiton complanatus* Hull; *Craspedoplax variabilis* H. Adams & Angas; *Cryptoplax larvæformis* Burrow; *Cryptoplax burrowi* E. A. Smith; *Liolophura queens-*

*landica* Pilsbry; *Acanthozostera gemmata* Blainville; *Lucilina fortilirata* Reeve.

*Remarks.* *Ischnochiton luticolens* and *Haploplax arbutum* were common.

*Callistelasma generos* was taken at the east end of the landing beach in front of the hospital on Fantome Id. Two specimens were obtained. They were on the under side of large smooth stones below low water.

*Lophochiton granifer* was taken both at Palm Id. (type locality) and Fantome Id. These last two shells were not taken by the writer outside the Palm Group.

*Acanthochiton granostriatus* had not been previously recorded from North Queensland. Single specimens were obtained from Emu Park, Magnetic Id. and Fantome Id.

Some specimens of *Lucilina fortilirata* were taken from under large stones, embedded in wet sand rather high on the beach. Others from dead shell and stones below low water level.

At both Palm and Fantome Islands large areas of coral are exposed at lowest tides. No Loricates were taken on the actual coral, but *Lophochiton granifer*, *Acanthochiton granostriatus* and *Acanthochiton complanatus* were found on dead shell such as *Pinna* and *Tridacna*.

#### I. Mourilyan Harbour (Robinson's Beach).

This rather out-of-the-way place was visited first on September 8, 1928 (tide + 12) and again on July 5th to 8th inclusive, 1929 (tide — 2). It is somewhat difficult of access. One may go by cane tram or steamer from Innisfail to Mourilyan Harbour. Thence by launch to Robinson's Beach, which lies south of the harbour. A hut offers shelter if a stay is planned. It may also be approached by flatboat across the harbour, and thence by a good track through the jungle.

Slates, schist, quartzite, quartz and basalt were noted on the fore-shore.

8 genera, 10 species were taken.

*Ischnochiton examinandus laetior* Hull; *Ischnochiton luticolens* Hull; *Haploplax adelaidensis* Reeve; *Haploplax arbutum* Reeve; *Callistelasma periousia* Iredale & Hull; *Craspedoplax variabilis* H. Adams & Angas; *Rhysoplax venusta* Hull; *Liolophura queenslandica* Pilsbry; *Acanthozostera gemmata* Blainville; *Lucilina fortilirata* Reeve.

*Remarks.* On the second visit rough weather from the south-east spoilt what should have been one of the most favourable tides for the year.

The locality of *Ischnochiton examinandus laetior* is given by Iredale and Hull (14) as Caloundra and Point Cartwright. The writer has traced it over 1,000 miles north of this. It is plentiful in the north (Solanderian Area), whereas it is scarce in the southern locality. In considering overlapping between Peronian and Solanderian Areas, it seems more reasonable to regard it as a Solanderian shell, which has invaded the Peronian Area than vice versa. Reference has already been made to the constant colouring of Mourilyan specimens of this shell.

Some remarkable specimens of *Haploplax adelaidensis* were found here, running up to a maximum size of 29 mm. This shell was found at a certain part of Robinson's Beach in 1928. When the same place was visited in 1929 the tides were lower (— 2 as against + 12). Working over the identical area we were puzzled to find no specimens. On the following day, remembering the proclivity of the genus *Haploplax* for high levels, special search was again made in the same place. A number of specimens were then found deeply buried in shingle under a double layer of stones. At the neap tides they had been more superficially placed and had been found at once.

Some modification of the description of *Ischnochiton luticolens* is necessary. In the type locality, Port Curtis, it is "Buff or pale brown, sometimes stained with blackish-brown" (15). In cleaner waters further up the coast (Emu Park, Magnetic Id., Palm Group, Mourilyan Harbour) it is most commonly white or pale greenish-white splashed and mottled, especially in the lateral areas with green, brown or black. The position of the mucro has been given as "in front of the middle," and this feature has been quoted to distinguish this shell from *Ischnochiton distigmatus* Hull. A series of camera lucida tracings shows that the position of the mucro is a little variable. It is most commonly central, although it may be a little anterior or posterior (figs. 1-5).

*A Note on the Relationship between Ischnochiton luticolens Hull and Ischnochiton distigmatus Hull.*

*Ischnochiton luticolens* Hull, is a very common shell in North Queensland.

The description of *Ischnochiton distigmatus* Hull, rests upon two or three shells found by Hull at North Head, Port Denison, Queensland.

In some respects these two shells seemed related.

The points relied on to separate them were as follows:—

1. *Specific Colouring.*

*luticolens* is buff or pale brown, sometimes stained with blackish brown in the type locality. In other places white or pale greenish-white splashed or mottled, especially in the lateral areas with green, brown or black (as noted supra).

*distigmatus* is purplish brown when alive, fading when dry, leaving a dark purple spot on each side of the jugum near the posterior margin of valve iv.

2. *Sculpture.*

*luticolens*, the median valves showed some difference of sculpture in median and lateral areas.

*distigmatus* showed no such difference.

3. *Shape of Posterior Valve.*

A. *Mucro*, said to be considerably anterior in *luticolens*, and only slightly anterior in *distigmatus*.

(The writer has previously shown in this article that for practical purposes the mucro is central in *luticolens* so this point of difference lapses).

B. *Post-mucronal area*, said to be concave in *luticolens* and convex in *distigmatus*.

4. *Slitting.*

*luticolens*, 15—1—13.

*distigmatus*, about 9—1—0 (in one case two obscure slits in median valve).

5. *Girdle.*

*luticolens*, minute striated scales.

*distigmatus*, small, elongated, lozenge-shaped scales directed backward and outward, not striated.

The Radulas were not recorded.

(The above is largely extracted from Monograph of Australian Loricates, Iredale and Hull, pages 20, 21).

*Remarks.* The writer, as noted earlier, took, at Pialba, two small shells, which outwardly conformed to the description of *Ischnochiton distigmatus*.

On disarticulation and comparison with a number of specimens of *luticolens*, it was found that the new shells did not exactly correspond with either *luticolens* or *distigmatus*.

They agree with *distigmatus* for colour, inasmuch as they were purplish-

brown when alive, fading when dry and having the characteristic purple spots on the fourth valve. In addition, they showed fine purple splashes under magnification.

No differentiation was observed in the sculpture of median and lateral areas, so that they agreed with *distigmatus* in Point No. 2.

*Post-mucronal Area* (figs. 6 & 9) is concave in Specimen A. and concavo-convex in Specimen B.

*Slitting.*

*Specimen A.* Anterior Valve, 10 rays, 10 slits, of which 5 are feeble.

Median Valve, single slit in each, some being weak, but none absent.

Posterior Valve, 6 slits of which 3 are feeble (Fig. 8).

*Specimen B.* Posterior Valve, 9 slits of which 3 are feeble (Fig. 10).

*Girdle*, minute striated scales apparently identical with those of *luticolens*.

*Radula* has not yet been examined.

The Pialba shells, therefore, agree with *distigmatus* as regards colour and sculpture. The girdle is that of *luticolens*. In the shape of the posterior valve and slitting they are intermediate. They might be a weakly slit *luticolens* or a strongly slit *distigmatus*.

The slitting in *luticolens* is sometimes weaker, and the slits may be fewer in number.

The writer records his shells as *distigmatus*. It must be admitted that the discovery of this intermediate form brings *distigmatus* much closer to *luticolens*. It is evident that an evolutionary process with modification of sculpture and slitting is taking place.

*Postscript.*

Since the foregoing notes were written, the author has had an opportunity of examining the type of *Ischnochiton distigmatus* Hull, in the Queensland Museum.

Iredale and Hull, in the Monograph of Australian Loricates (p. 21), state that the girdle scales are not striated, and the writer quoted this feature as one of the points which distinguish this species from *I. luticolens*.

Since examination of the type, the present writer cannot concur with the description of the girdle scales. Under magnification of 75 diam. these are seen to be clearly striated and similar to those of *I. luticolens*. The shape of the post-mucronal area (another point of differentiation) may be

*Figures.*

- Fig. 1. *Ischnochiton luticolens*, 12 mm. long, from Magnetic Id. Posterior valve, side view.
- Fig. 2. *Ischnochiton luticolens*, 12 mm. long, from Mourilyan Harbour. Posterior valve, side view.
- Fig. 3. *Ischnochiton luticolens*, 10 mm. long, from Magnetic Id. Posterior valve, side view.
- Fig. 4. *Ischnochiton luticolens*, 9 mm. long, from Mourilyan Harbour. Posterior valve, side view.
- Fig. 5. *Ischnochiton luticolens*, 11 mm. long, from South Keppel Id. Posterior valve, side view.
- Fig. 6. Specimen A., from Pialba, 8 mm. long. Posterior valve, side view.
- Fig. 7. Specimen A., from Pialba, 8 mm. long. Posterior valve, from above.
- Fig. 8. Specimen A., from Pialba, 8 mm. long. Posterior valve, interior.
- Fig. 9. Specimen B., from Pialba, 7 mm. long. Posterior valve, side view.
- Fig. 10. Specimen B., from Pialba, 7 mm. long. Posterior valve, interior.
- Fig. 11. *Ischnochiton distigmatus* (type), side view of posterior valve.





FIG. 1

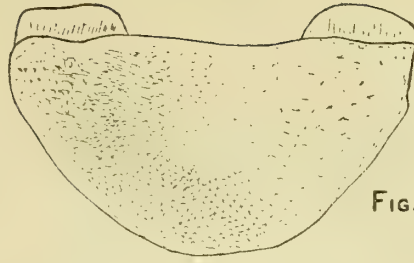


FIG. 7



FIG. 2

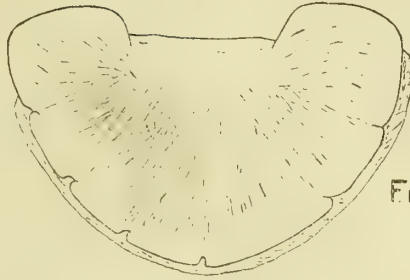


FIG. 8



FIG. 3



FIG. 9



FIG. 4

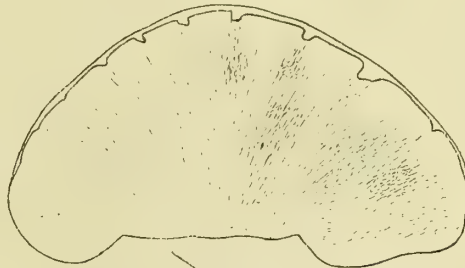


FIG. 10

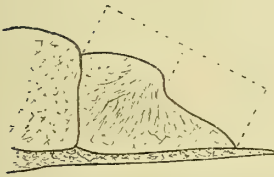


FIG. 5



FIG. 6

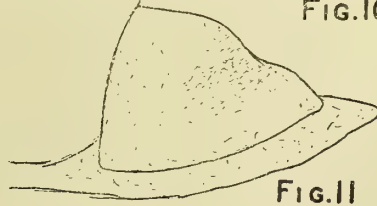


FIG. 11

described as concavo-convex. A camera lucida tracing of its outline is given (Fig. 11). One of the writer's Pialba shells has the same outline.

The writer considers his Pialba shells to be conspecific with the shell described by Hull as *I. distigmatus*.

The question again arises as to how far *I. distigmatus* is separable from *I. luticolens*. The only cited points of difference which survive analysis are as follows:—

1. Distinctive colour. An uncertain feature, unless well supported by other facts.

2. Some small difference of sculpture.

3. Weaker slitting in *distigmatus*.

To these the writer would suggest:—

4. Shape. *I. luticolens* is long and narrow. *I. distigmatus* is a shorter, wider shell.

5. Elevation. *I. luticolens* is an elevated shell. *I. distigmatus* is depressed.

It must be admitted that the number of *I. distigmatus* available for comparison is small, and too much stress must not be laid on points 4 and 5 until more specimens are found.

The writer considers that *I. distigmatus*, though separable, is more closely related to *I. luticolens* than has been supposed.

To his previous acknowledgements he desires to add his thanks to the Director of the Queensland Museum, Mr. Heber A. Longman, for his courtesy in providing facilities for examination of their collection of Loricates.

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To Department of Harbours and Marine, Brisbane, for copy of Tide Tables.

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OBSERVATIONS ON THE PLATYPUS (*ORNITHORHYNCHUS ANATINUS*).

## 1. THE EGG-LAYING PERIODS.

By HARRY BURRELL, C.M.Z.S.

Who can say whether or not there is sufficient anatomical evidence available to prove beyond doubt that it is impossible for a Monotreme to lay fertile eggs twice in one season? If there is, I am not aware of the fact. If not, food for thought may here be garnered.

As far as the higher order of mammals is concerned, I do not know of an instance where any of these creatures has given birth to young twice in the one year, save, of course, in the case of twins or litters. But as my investigations are restricted to Monotremes (a so-called lower order), I am not greatly concerned about the placentals.

Apart from the fact that I have collected very young Platypus which, I was convinced, had been hatched during the month of August, I have since then collected eggs laid during that month. The latest date upon which I have taken eggs from a nest is November 13 (1929). These I presented to the Australian Museum for gallery exhibits. This find brought the egg-laying period of the Platypus into four months, namely, August, September, October, and November. In respect of the November eggs, it may be pointed out that I had deliberately arranged to await late dates—dates most suitable for the unearthing of furred nestlings, though at the risk of learning that they had already deserted their nests—and I said to my assistants: "Do not be surprised if we should happen upon new-laid eggs instead of the usual furred young, or deserted nests." My reason for saying this was not because I imagined we might chance finding eggs; it was based upon the fact that I had previously (late in October) taken twin ova from the oviduct of a Platypus, and, judging by their size (about three millimetres each), they, probably, would not have been deposited before early November. Sure enough, as I had warned my associates, I succeeded in collecting twin new-laid eggs three days afterwards. From a bank of the Manilla River, N.S.W., on the date mentioned (November 13, 1929), we unearthed a female Platypus and twin new-laid eggs. (For full description of new-laid eggs, see *The Platypus*, page 180). The main entrance to the burrow of this find was discovered two feet above water level. Following its trend for some considerable distance, we ultimately came to the nest, which was situated high up in the bank. Before breaking through to the occupant, I noticed a new aperture running in at right angles to the tunnel we were tracing; but, knowing we would have to break through this by following our selected course, I did not bother just then to make special observations, more than to notice its freshness and direction. Delving a little further, a female nesting Platypus waddled out, unexpectedly, towards the digger. After testing her milk glands to ascertain their condition, she was granted a fairway in the river. I turned my attention then to the contents of her nest, and, instead of finding, as usual, one big babe, or more, twin new-laid eggs met my gaze.

The excitement over, we resumed digging back towards the new entrance, and while doing so we quite accidentally unearthed another new, though deserted, nest within two feet of the former find. Here was a puzzle;

for, as already stated, the labyrinth system of tell-tale tunnels had been demolished before any knowledge of the ultimate results was gained. I will not dwell longer on this point, further than to state that the new aperture could have led, with some intricacy, to either or both nests.

The problem facing us now is whether both nests were constructed and occupied by the one female during a single brooding session. Personally, I think it possible. All present were convinced that the new aperture was unworn, as the outer grass was not disturbed thereabouts. Had the material for the occupied nest been carried through this tunnel there would have been no mistaking the worn trail; for *Platypus* nests are bulky and the material can be carried in only a little at a time. This would necessitate many trips, both in and out, before the task would be finished. Accordingly, I dismiss any suggestion that the new opening was anything but an accidental break from within, and, probably, had been created before the creature pugged herself in prior to laying her eggs. (Such conditions are customary). The fact that the eggs were new-laid proves that this she had only recently done. Hence the untraversed aperture that bewildered me at the time.

Here is another point which strengthens my theory somewhat: The first nest discovered was found to be occupied; the other, almost adjoining, was only recently deserted. These conditions I know from experience, and, according to the date, the second nest had evidently been occupied by nestlings just prior to our investigations. This nest, then, was certainly built by the female that constructed or renovated the principal burrow that season, for we may be sure she would not allow an intruding female to trespass on her quarters at the time when she was most alert, suckling half-grown nestlings. Somewhat similar conditions prevail, though, in cases where two females begin operations practically together, but at that tunnelling time both are presumably of the one mind. However, as regards the limit of neighbourly possibilities among brooding *Platypus*, the above is my firm opinion, and, furthermore (although not an anatomist), I am of the opinion that the one female was responsible for the double event.

To my mind, the most feasible theory contrary to the one submitted is this: A second female commandeered the quarters directly after the six-weeks-old nestlings had vacated them. This appears convincing, because she did not make shift in the deserted cavity, a fact which indicates that she evidently was not pushed for time, even at that late stage. The entrance to the cavity was blocked, so let us suppose that she was responsible for the blocking of it before tunnelling, erratically, two feet further on, there to excavate a cavity for herself. Then, by way of that erratic sub-way she could simply go back again into the main tunnel, pugging behind her occasionally as she thought fit. Hence the mystifying labyrinth referred to.

Still, I have no hesitation in saying that the first female would have acted likewise if pressed to do so, and who can say that she was not? New and moist conditions are necessary at all brooding sessions. Therefore, it is not likely she would desert her original burrow, wherein she had already made good, to venture out elsewhere on another laborious task, just for exercise. Judging from the measurements of intra-uterine material, taken from specimens caught in the act of tunnelling, I find that Nature allows a female *Platypus* about two weeks to burrow and build her nest before the egg is ready for deposition. This time, if added to the period required for



laying, hatching, and tending young, would extend into approximately three months.

By this reckoning, then, one female may have been responsible for both clutches, and more especially if we take into consideration the fact that furred young can subsist for weeks without receiving nourishment from their mothers. Being aware of this, I presume that during this period not only conception, but the maturing and laying of eggs could take place. Meanwhile, the mother could excavate a second cavity and build another nest.

On the other hand, if two females were responsible for the double event, then the first must have been a very early layer, and the second exceptionally late. But why should such extremes clash in the one burrow found in a first-class bank containing from two to three hundred yards of most suitable soil? And yet no other occupied burrow was found that season along its entire length; nor was another female met with.

For the sake of brevity, in concluding this hypothesis, the following questions may be set out:—

- (1) Were these eggs a second laying in one season by one *Platypus*?
- (2) Can this be a natural occurrence with early layers?
- (3) Is it an anatomical impossibility for a *Platypus* to conceive under such circumstances?
- (4) Was it an unusual phenomenon entailing the slow functioning of the right uterus? (See *The Platypus*, p. 178).

## 2. TEMPERAMENTAL TRAITS.

Notwithstanding their nervous disposition and dread of man, *Platypus* when in difficulties, or in pain, will not only accept the hand of their foremost enemy to save or sooth them, but at such times will seek his assistance.

My first experience of this characteristic was with an adult female *Platypus*, one that I had unearthed while she was burrowing and had afterwards kept in solitary confinement for experimental purposes. Therefore, there can be no disputing the fact that she knew me only too well. After leaving her to herself for two days in comfortable quarters, I thought fit to give her a dip in a bucket three parts full of water. But as I was afraid she would climb out, after being submerged, I walked round the bucket so as to be on hand should she go over the top on the opposite side. As I walked round I noticed she paddled to keep pace with me, never turning her tail to me once; and when I stood still she did nothing but tread water, and, seemingly, beg of me to stoop and lift her out. This I proceeded to do, but instead of diving, as I fully expected she would, she raised her bill, looked me squarely in the face, and when I put out both hands she accepted my open palms as if she had never felt their clasp before. Nevertheless, the moment she recovered from the dread of being left to drown, she became equally afraid of the hands that had just lifted her to safety. Three days in succession I tested this subject, only to meet with similar results.

On another occasion, a male baby *Platypus* that I had snuggling comfortably in his original nesting material for several weeks, became so extremely alarmed when I relined his soiled nest with fresh vegetation that he did nothing but kick up his feet in protest at my interference. All was apparently well the while I soothed him, but the moment I withdrew my hands he went off again into tantrums, and not only did he squirm and growl at me, but when I tried to pacify him with the kindest voice a foster-

parent could evoke under any circumstances, he only growled and wriggled the more and, ultimately, stood up in the nest and "Gr-r-r-ed," imploring me to take him up. After discovering the error I had made in interfering with his own nest, I took him up and removed the stuff I had unwisely added for his comfort. When all was in readiness I put him back again, and without any further fuss he coiled up and slept contentedly the whole day through. Unlike the adult, this baby appeared to be grateful to me, but only until I had righted an experimental wrong; then he ceased to require my services.

My next experience was with a female baby Platypus (a twin to the first mentioned one), that evidently was in pain occasioned by diarrhoea. One evening, at dusk, when their sense of seeing is good, I was attracted to the weanery by an unusual scratching and calling. Making investigations, I found my patient writhing on the nest as if in convulsions. Thinking that a little exercise would relieve her, I took her out of the nest and placed her on a table. Presently, after more wriggling, she commenced to crawl about as if all pain had suddenly ceased. To prevent her from falling off the table, I placed my hands at either side of her. Noticing this, she made towards one hand and nuzzled between my fingers (this she frequently did while being groomed). Then she coiled herself in my palm and went to sleep. Possibly she was only seeking warmth. However, faith outweighed fear on that occasion, because, when I placed her in the nest again and withdrew the warmth of my hands, she continued to sleep on until awakened at 11 a.m. the following day—then to have her voice "canned" by Fox Movie-tone Company, when both she and her brother emitted defiant growls for the occasion. According to the manager of the company, the voices were successfully "shot" and reproduced to perfection. The above are not isolated cases, but I think they are sufficiently convincing in themselves to show that the *Ornithorhynchus*, though nervous and fretful, is blessed with sufficient perception to know when to choose the lesser of two evils.

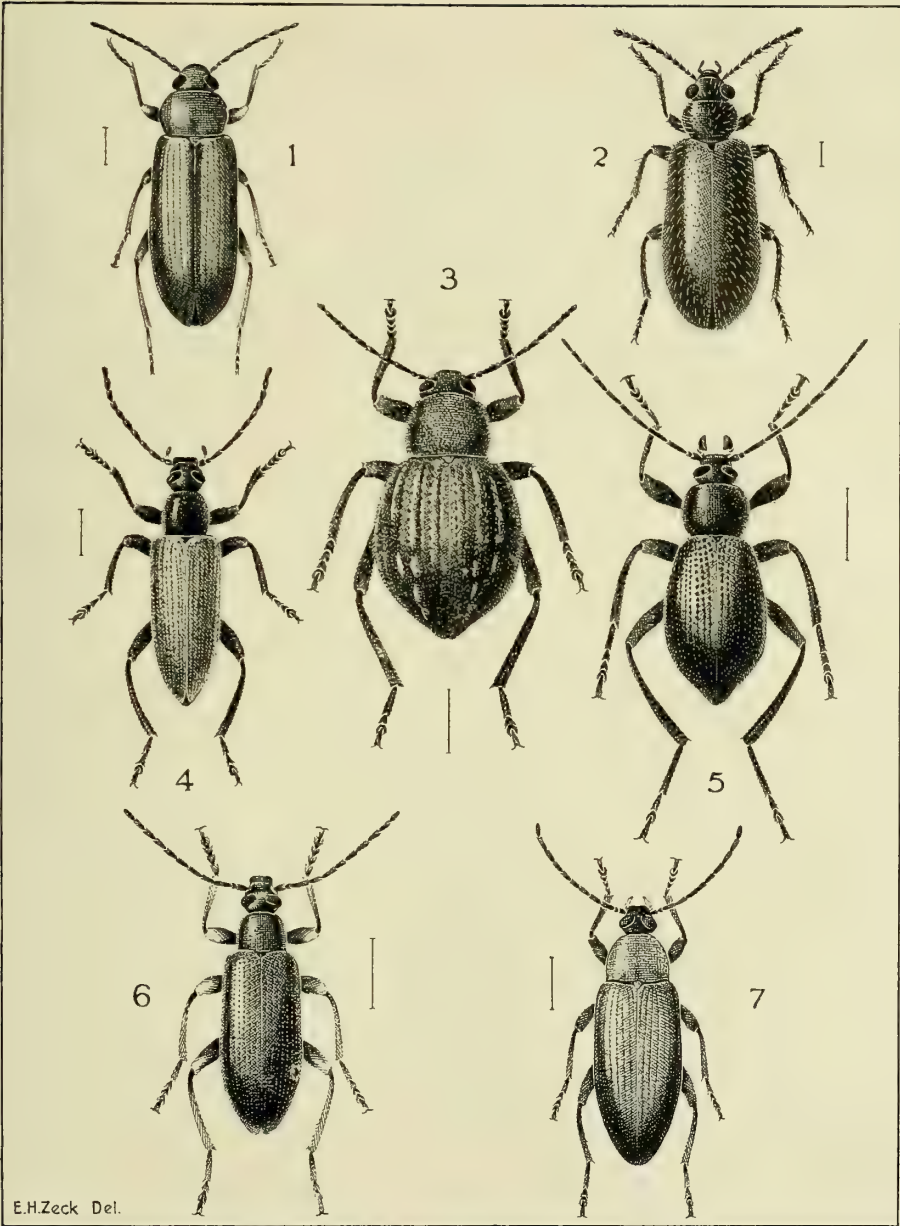


THE CICADA BIRD FEEDING YOUNG IN NEST.

Photograph by N. Chaffer.

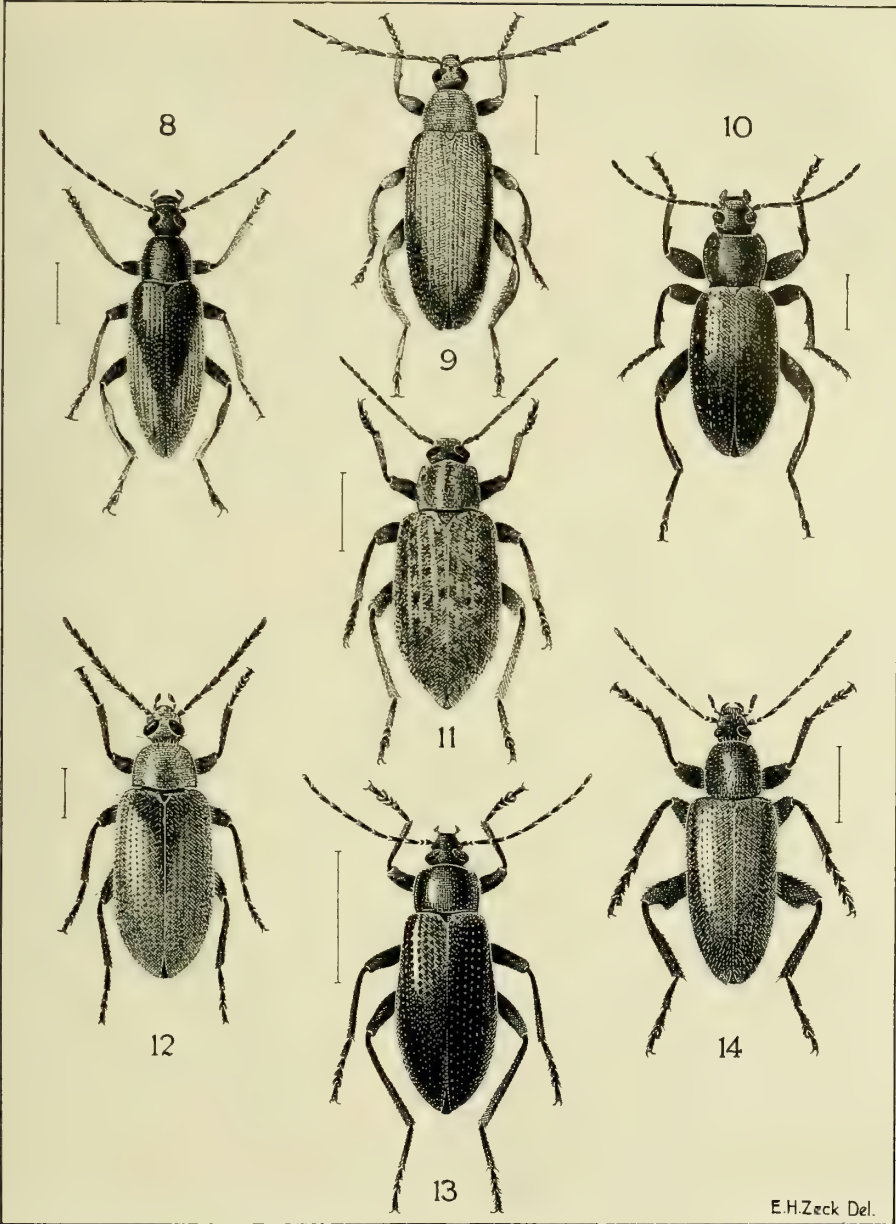






AUSTRALIAN CISTELIDAE.

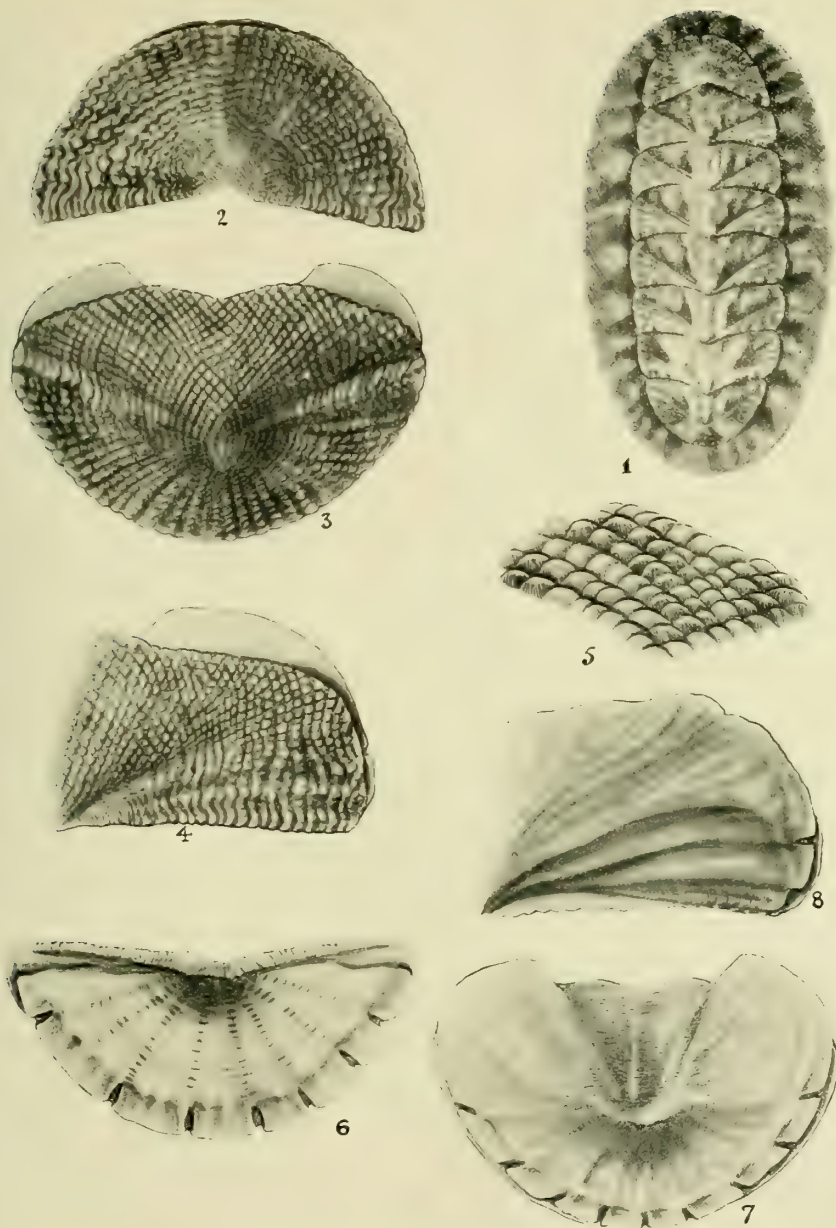




AUSTRALIAN CISTELIDAE.





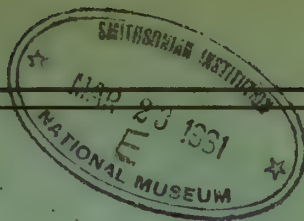


*Ischnochiton acomphus* Hull & Risbec.

1. Whole shell. 2. Anterior valve. 3. Posterior valve. 4. Half median valve.
5. Girdle scales. 6. Interior of anterior valve. 7. Interior of posterior valve.
8. Interior of median valve.



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ON THE RESTRICTION OF THE GENUS *Ferdina* GRAY (ASTEROIDEA).

By ARTHUR A. LIVINGSTONE.

The Australian Museum, Sydney.

(With the permission of the Trustees of the Australian Museum.)

Plates xxi.-xxiv.

The study of a species of a genus believed to be new has led to a revision of its generic associates, with the result that some further information has been gathered which will, it is believed, throw some more light upon this little-known group.

Although Gray's specimens of *F. cumingii* and *F. flavescens* in the British Museum cannot be made available to me, I have been kindly supplied with helpful notes and photographs by the authorities of that institution.

It is considered that the species at present allotted to *Ferdina* should be separated and placed under two distinct genera. This would entail the restriction of *Ferdina* and the erection of a new genus, a course which is followed herein. In adopting the view that the genus *Ferdina* should be split I have been partially influenced by the additional information at hand and partly by the statement of H. L. Clark (1). "It seems to me quite possible that *cancellata* and its allies are not congeneric with *flavescens*." The species *cumingii* Gray, which is linked with *flavescens* in Clark's work, has been omitted from the quotation, for it is not related, as that author was led to surmise through Gray's deceptive descriptions.

*F. cancellata* Grube, is treated hereafter as a probable synonym of *F. cumingii* Gray.

The regrouping of the species is as follows:—

Family OPHIDIASTERIDAE Verrill.

Genus *Ferdina* Gray (restricted).

*Ferdina* Gray, Ann. Mag. Nat. Hist., 6, 1840, 282 (part).

*Ferdina* H. L. Clark, Ech. Fauna Torres Strait, Dept. Mar. Biol., Carneg. Inst., Washington, x., 1921, 58 (and authors in part).

*Genotype*.—*Ferdina flavescens* Gray (*loc. cit.*). Designated by Fisher, 1919.

*Generic diagnosis*.—Abactinal plates not in regular longitudinal series. Papulae isolated and confined to abactinal surface. Adambulacral armature in a single series. Marginal, actinal and abactinal plates uniformly granulated, not bare, either wholly or partially. Abactinal plates not uniform in size and never arranged in any regular order or series, either longitudinally or transversely.

The species belonging to this genus as here understood are:—

*Ferdina flavescens* Gray.

*Ferdina heffernanii* sp. nov.

*Ferdina flavescens* Gray.

*Ferdina flavescens* Gray, Ann. Mag. Nat. Hist., 6, 1840, 282.

*Ferdina flavescens* de Lorient, Mem. Soc. Phys. Hist. Nat. Genève, xxix., No. 4, 1885, 47, pl. xv., figs. 8a-8e.

*Ferdina flavescens* H. L. Clark, Ech. Fauna Torres Strait, Dept. Mar. Biol. Carneg. Inst. Washington, x., 1921, 59.

Pl. xxi., fig. 4; Pl. xxii., figs. 1-3.

As the characters of this species are so well described and figured by de Lorient, and its history brought up to date by H. L. Clark, there is prac-

(1). Clark, H. L., Ech. Fauna, Torres Strait. Dept. Mar. Biol., Carneg. Inst., Washington, x., 1921, 58-59.

tically nothing I can add from the photographs before me. However, as the photographs are of Gray's type specimens, it has been considered advisable to reproduce them.

Photographs examined are of two specimens measuring as follows:—

R. = 26 mm. r. = 8.5 mm.

R. = 21 mm. r. = 8 mm.

The species is known only from Mauritius.

*Ferdina heffernanii* (2) *sp. nov.*

Pl. xxiv., figs. 1-5.

*Description*.—Rays five, long and slender, tapering gradually. R. = 40 mm. r. = 7 mm. Br. = 7.5 mm. Disc and rays flat, interbranchial arcs subacute. Abactinal surface, exclusive of superomarginals, covered by plates ranging in diameter from 0.5 mm. to 2 mm. and not arranged in any regular order, either longitudinally or transversely. The largest plates, which are few in number, are, like their smaller fellows, evenly clothed in dense granules, but differ from these latter in having their central granules much larger and more conspicuous. The largest abactinal plates are strongly convex, while the smaller plates around them are nearly flat. No centrally naked plates occur anywhere on the specimen. In the figured type specimen some plates have been deliberately denuded to see if a plate similar in appearance to some of those in *cumingii* and allies could be produced. No such result was obtained, and in no way could the smooth bald effect so characteristic of *cumingii* be produced by rubbing away the granular covering.

Superomarginals 17-19 arranged in an irregular series, made up of alternating larger and smaller plates. The large plates of the series are strongly convex, and the smaller ones almost flat. The large plates are clothed in dense granules, coarsest centrally, while the smaller plates are evenly granulated all over. The alternation of the superomarginals is not perfect. The first superomarginal of each series is not conspicuously enlarged. Terminal plate very small, smooth, bare, slightly swollen, and bearing two or more terminal tubercles. Papulae isolated, not arranged in any regular order; confined to abactinal surface, though occasionally some may occur between the marginals.

Inferomarginals 18-21; they are of varying form, making a somewhat irregular series. Most are large and have their central granules enlarged as in the superomarginal series. Odd plates occur here and there between the marginals.

Adambulacral plates numerous, 50-68. Each is provided with two conical flat-sided furrow-spinelets which may be sharply pointed or blade-like. Further, each adambulacral plate bears, in addition to a wealth of small granules, a central conical spine-like granule, which is either absent or only ill-defined in plates near the mouth. Only two series of actinolateral plates occur. The first series runs almost the entire length of the ray, and numbers, in the largest rays, between 27 and 32. The second series is comprised of from 2-3 plates and ends between the second and third superomarginal. All actinolateral plates, except those near the mouth, are clothed in dense granules and bear centrally a mass of prominent granules conical in shape and distinctly larger in size than those anywhere else on the specimen. These granules on the actinolateral plates are so con-

(2). Named for N. S. Heffernan, Esq., formerly Deputy Commissioner for the Western Pacific, Honorary Correspondent to the Australian Museum. As a guest of this gentleman, the author and a colleague were able to accomplish extensive scientific work in the Santa Cruz Islands.

spicuous that they can be detected with the naked eye. Oral spinelets small, the innermost largest. Oral plates clearly defined by channel-like deficiencies in the granulation. No pedicellariae.

The colour in a dried condition is pale creamy brown.

This sea-star can at once be distinguished from its generic ally by its slender rays and form of granulation. It differs from species of *Fromia* in having no actinal papulae. It was collected alive on sand in a sheltered coral pool in about six feet of water at low tide. The common coral, *Fungia* sp., was found living in abundance nearby.

*Locality*.—S.E. side of Santa Cruz Island, Santa Cruz Group, Western Pacific. Collected by E. le G. Troughton and A. A. Livingstone, August, 1926. Type in Australian Museum, Reg. Number J. 5089.

Genus NEOFERDINA nov.

*Ferdina* Gray (*loc. cit.*) and authors—in part.

*Genotype*.—*Ferdina cumingii* Gray.

*Diagnosis*.—Papulae isolated. Some of the marginal and abactinal plates conspicuously bare, never all clothed in dense granules as in *Ferdina*. In some cases the bare and conspicuously convex plates on the abactinal surface may be arranged in transverse and longitudinal series. Superomarginals usually more conspicuous than in *Ferdina*.

The species allotted to this genus are:—

*Neoferdina cumingii* (Gray).

" *glyptodisca* (Fisher).

" *kuhlii* (M. and Tr.).

" *offreti* (Koehler).

" *ocellata* (H.L.C.).

" *cancellata* (Grube).

*Note*.—*N. cancellata* is probably a synonym of *N. cumingii*.

NEO FERDINA CUMINGII (Gray).

*Ferdina cumingii* Gray, Ann. Mag. Nat. Hist., 6, 1840, 283.

? *Ferdina cumingii* Perrier, Rev. Stell. du Mus. d'Hist. Nat., Paris, 1875, 184.

Non *Ferdina cumingii* H. L. Clark, Ech. Fauna Torres Strait, Dept. Mar. Biol. Carneg. Inst. Washington, 1921, 59 (characters of species misunderstood owing to Gray's deceptive description).

Pl. xxi., figs. 1-3; Pl. xxiii., figs. 1-2.

As this species is now the genotype of the new genus *Neoferdina*, it is necessary for its structural characters to be made perfectly clear. In the past it has been an enigma to systematists, both in relation to type locality and points in structure. As it is not the custom for the British Museum authorities to lend type material, I have been favoured by notes and photographs as a substitute. These clear up essential points in structure, but naturally throw no light upon the true locality from whence the specimens came. On the other hand, the locality given to me by the authorities at the British Museum only confirm Gray's and Perrier's statements that they came from the "West Coast of Columbia." We are, therefore, no further advanced in the effort to substantiate the belief set out by H. L. Clark (*loc. cit.*) that the specimens possibly came from the Philippines.

As regards structure, however, much of the mystery existing can be cleared away. In the first place there is no doubt that the species is of the bare plated type, having many abactinal and marginal plates bare and smooth centrally. Furthermore, it so closely approaches the "*cancellata* group" that *cancellata* itself may be absorbed as a synonym, but a definite course on this point is not possible because the early literature, so vital to such a question, is not available to me. Sufficient information, however, is

before me to question the validity of *cancellata*. Where *cumingii* so closely links itself with *cancellata* is in the arrangement of the bare transverse plates on the abactinal surface of the rays. Fisher (1919) and H. L. Clark (*loc. cit.*) both give this character as a distinguishing feature for *cancellata*. Clark's *N. ocellata* is, I think at present, a valid species, but when further data are forthcoming it too may be reduced to a synonym of *cumingii*.

The following description of *N. cumingii* from notes and photographs will further show its close relationship with *cancellata*. Further, it is hoped that by its publication, together with the photographs, authors in possession of the earlier literature of *cancellata* will have an opportunity to prove or disprove my doubts as regards the status of the two species.

*Description*.—Disc and rays depressed; interbranchial arcs subacute. Abactinal surface covered by plates measuring between 0.5 and 2 mm. in diameter. These plates assume various degrees of convexity, though the largest of them are more strongly convex than their smaller fellows. The abactinal plates are not arranged in any regular order excepting a median radial series and a small number of transverse series. The plates of the median radial series in Gray's three specimens number anything between six and thirteen, according to the size of the specimen, and extend from the disc to the distal part of the ray, thereby differing from *N. ocellata* which has the median radial plates confined to the basal half of the ray. From five to six transverse series of tubercle-like plates, four to six plates in each series, occur on the abactinal surface of each ray, thereby agreeing with *cancellata*. In Gray's three specimens the superomarginal plates range from twelve to sixteen in number and are arranged in an alternating series of large and swollen and small and flatter plates. This alternating arrangement is not always perfect, as abnormalities occasionally occur.

As in other species, the transverse series of medium sized plates on the abactinal surface of each ray lie opposite the smaller superomarginals. The first superomarginal of each series is no larger than any of its fellows, therein differing from *N. ocellata* (H.L.C.) which has, as described by Clark and seen by me in specimens of the species in the collection of the Australian Museum, very large plates at the beginning of the series. The terminal plate is round and swollen. The inferomarginals correspond in number with the superomarginal series, and from the photographs seem to assume the same alternating arrangement.

Most marginals, median radials and plates of the transverse series are bare centrally, the granulation ending abruptly and conspicuously at or near their bases. The remaining plates on the abactinal surface are clothed in dense granules. Madrepore and anal aperture not sufficiently detailed in the photographs to describe.

Papulae fairly numerous, isolated and devoid of any regularity in arrangement.

Adambulacral plates numerous, squarish or occasionally rectangular. There are two adambulacral spinelets to each plate, according to the notes before me from the British Museum.

Three series of actinolateral plates are present. The plates of the series, like the adambulacrals, are densely granulated. The first series of actinolateral plates extends nearly to the tip of the ray. The second reaches the eighth inferomarginal, while the third ends between the third and fourth inferomarginal.

Actinal papulae absent.

*Locality*.—"West Coast of Columbia" (Gray).

*Specimens examined*.—Photographs of three of Gray's type specimens.



## NEOFERDINA KUHLLI (Muller and Troschel).

*Scytaster kuhlii* Muller and Troschel, Syst. der Asteriden, 1842, 36.

*Ferdina kuhlii* H. L. Clark, Ech. Fauna Torres Strait, Dept. Mar. Biol. Carneg. Inst. Washington, x., 1921, 61.

Acting upon the supposition that the type specimen or specimens of this species were in the collection of the Leyden Museum, application was made for the loan of them, but information received in answer shows that the type material, or any other species of the genus, is not housed in that institution.

## EXPLANATION OF PLATES.

## Plate xxi.

- Fig. 1. *Neoferdina cumingii* (Gray). Abactinal view of one of Gray's type specimens. x2.  
 „ 2. *Neoferdina cumingii* (Gray). Actinal view of same specimen as fig. 1. x2.  
 „ 3. *Neoferdina cumingii* (Gray). Abactinal view of a small type specimen. x2.  
 „ 4. *Ferdina flavescens* (Gray). Abactinal view of one of Gray's type specimens. x2.

## Plate xxii.

- Fig. 1. *Ferdina flavescens* (Gray). Actinal view of same specimen as shown, Pl. 1, fig. 4. Absence of granules in one place obviously not natural. x2.  
 „ 2. *Ferdina flavescens* (Gray). Actinal surface of ray of one of Gray's type specimens. x6.  
 „ 3. *Ferdina flavescens* (Gray). Abactinal surface of ray. x6.

## Plate xxiii.

- Fig. 1. *Neoferdina cumingii* (Gray). Abactinal view of ray of one of Gray's type specimens. x6.  
 „ 2. *Neoferdina cumingii* (Gray). Actinal view of ray of one of Gray's type specimens. x6.

## Plate xxiv.

- Fig. 1. *Ferdina heffernanii* sp. nov. Portion of abactinal surface of ray. x6.  
 „ 2. *Ferdina heffernanii* sp. nov. Actinal surface in vicinity of mouth. x5.  
 „ 3. *Ferdina heffernanii* sp. nov. Portion of actinal surface of ray. x6  
 „ 4. *Ferdina heffernanii* sp. nov. Actinal view. Slightly over nat. size.  
 „ 5. *Ferdina heffernanii* sp. nov. Abactinal view. Slightly over nat. size.

## NEW NAMES FOR AUSTRALIAN FISHES.

By GILBERT P. WHITLEY,

Ichthyologist, The Australian Museum.

(With the permission of the Trustees of the Australian Museum.)

Plates xxv.-xxvii.

Family HEPTRANCHIIDAE.

Genus HEPTRANCHIAS Rafinesque, 1810.

HEPTRANCHIAS DAKINI, new species.

A new specific name is required for the south-eastern Australian species figured by McCulloch (Zool. Res. Endeavour, i., 1911, 2, pl. i., and fig. 1) as *Heptranchias perlo* (Bonnaterre), as it appears to differ from that European species notably in having the head  $4\frac{1}{2}$  in total length and anal originating below middle of dorsal, with its base shorter than that of dorsal. The holotype of *H. dakini* is the specimen from sixty miles south of Cape Everard, Victoria, figured by McCulloch.

Named after Professor W. J. Dakin, of the University of Sydney.

Family HETERODONTIDAE.

MOLOCHOPHRYS, new genus.

Orthotype, *Cestracion galeatus* Günther (Cat. Fish. Brit. Mus., viii., 1870, 416, Australia; i.e., New South Wales) = *Molochophrys galeatus*.

Supraorbital crest high, terminating abruptly behind the orbit. Origin of first dorsal above posterior end of base of pectoral. Posterior caudal lobe with the hind margin obliquely truncate, without incision. No spots on body or fins. Egg-case with long tendrils at one end.

The Crested Port Jackson Shark (*Molochophrys galeatus*) has much higher supraorbital crests than the Common Port Jackson Shark (*Heterodontus portusjacksoni*), which is also differently coloured. I may here remark that *Squalus philippinus* Shaw (Gen. Zool., v., 2, Pisc., 1804, 342. *Er* Lacépède. Botany Bay) and *Squalus jacksonii* Turton (Syst. Nat. Linné, 1806, 922; Bullock, Compan. Bullock's Mus., ed. 8, 1810, 60 and Compan. London Mus., ed. 17, 1814, 90 and pl. —, figs. 1-2, Port Jackson) are synonyms of *Heterodontus philippi* (Bloch and Schneider) auct. = *Squalus portusjacksoni* Meyer, 1793, which have been generally overlooked. A true Squalid Shark from the Philippine Islands named *Squalus philippinus* by Smith (Proc. U.S. Nat. Mus., xli., 1912, 677, pl. li. Off Luzon) is unfortunately preoccupied by Shaw's name, and may now be known as *Squalus montalbani*, new species.

Family CARCHARINIDAE.

NOTOGALEUS, new genus.

Orthotype, *Galeus australis* Macleay (Proc. Linn. Soc. N.S. Wales, vi., September 12, 1881, 354. Port Jackson) = *Notogaleus australis*.

First dorsal situated over a space about midway between pectorals and ventrals. Second dorsal subequal to anal, and originating a little in advance of it. Subcaudal lobe well developed, giving a characteristic "double-tailed" appearance. Coloration greyish, without spots or bars.

Family SCYMNORHINIDAE.

SCYMNORHINUS PHILLIPPSI, new species.

New name for *Scymnorhinus licha* McCulloch (Biol. Res. Endeavour, ii., 1914, 81, pl. xiv., fig. 1 and text-fig. 1) which, as McCulloch hinted, is obviously not conspecific with the French *Squalus licha* Bonnaterre (Tabl. Encycl. Meth., Ichth., 1788, 12). The holotype is the male described and

figured by McCulloch, and the type-locality is the Great Australian Bight, in deep water.

Named after Mr. William John Phillipps, the New Zealand ichthyologist.

Family ECHINORHINIDAE.

Genus ECHINORHINUS Blainville, 1816.

ECHINORHINUS (RUBUSQUALUS) MCCOYI, new subgenus and species.

New name for *Echinorhinus spinosus* McCoy (Prodr. Zool. Vict., ii., dec. xv., October, 1887, 165, pl. cxliv. Portland, Victoria), which is obviously distinct from the European *Squalus spinosus* Gmelin (Syst. Nat. Linné, ed. 13, i., 3, 1789, 1500) = *Squalus brucus* Bonnaterre (Tabl. Encycl. Meth., Ichth., 1788, 11. "L'Océan"), as McCoy himself noted the numerous discrepancies in descriptions and figures. The holotype of *E. mccoyi* is the specimen (No. 50,760) in the National Museum, Melbourne, which was figured by McCoy in his excellent "Prodromus." It differs from a specimen of *Echinorhinus brucus* in the Australian Museum from Tuscany in having the eye over anterior portion of mouth, thicker and heavier tail, dorsal fins closer together, and first dorsal originating over anterior portion of anal, instead of originating almost over the middle of that fin. These changes in the positions of the fins induce me to regard *Echinorhinus mccoyi* as the genotype of a new subgenus, *Rubusqualus*.

Family ENGRAULIDAE.

AUSTRANCHOVIA, new genus.

Orthotype, *Atherina australis* White (Journal of a Voyage to new South Wales, 1790, 296 and fig.) = *Austranchovia australis*.

Gill-membranes united across isthmus anteriorly by a fine membrane. Ventral surface scarcely carinate, entirely without scutes. No free dorsal spine. Alar scale large. Anal fin free from the forked caudal and entirely behind dorsal. This new genus enters the *Cetengraulis* section of the key given by Jordan and Seale (Bull. Mus. Comp. Zool. Harvard, lxxvii., May, 1926, 358), but has fewer gill-rakers and anal rays, and more vertebrae than that American genus.

The type-species of *Austranchovia* has been fully dealt with by McCulloch (Rec. Austr. Mus., xiii., 1920, 43, pl. xii., fig. 1).

Family MURAENIDAE.

VERDITHORAX, new genus.

Orthotype, *Muraena prasina* Richardson (Zool. Voy. Erebus and Terror, Fish., 1843, 93. Bondi Bay, N.S.W. Type in Brit. Mus. = *Verdithorax prasinus*.

Mesial intermaxillary teeth slender. More than five teeth in inner maxillary row. Vomerine teeth biserial anteriorly and forming a single row posteriorly (Richardson). Posterior nostrils without elevated rim. Dorsal fin commencing a little before vertical of gill-opening.

Coloration nearly uniform bright green in life, but changing to dark brown after death. Several dark longitudinal grooves from angle of mouth and along throat. Eye blue. Specimens from New South Wales examined by me have depressible fangs on intermaxillary. Cleft of mouth almost half length of head, dorsal fin low and adipose.

*Verdithorax prasinus* is common amongst rocks along the New South Wales coastline and feeds on crabs and other animals. It is very vicious and many people have been bitten by this eel, though blood-poisoning has not apparently been recorded as a result (Paradice, Med. Journ. Austr., ii., 25, 1924, 650). Mr. F. McNeill made the following note on a specimen observed by him at Maroubra, near Sydney:—"The green pigment which

constitutes its colour-marking had stained the walls of its home, and for some distance in front the sand-grains were lightly tinted with the same colour." An adult example, nearly thirty inches long, was caught in 15 fathoms of water off North Head, Port Jackson, on December 5, 1926, by W. E. J. Paradise. It contained a large number of fair-sized eggs, the roe occupying a large portion of the abdominal cavity. Young Green Eels have been caught in rock-pools in November and December near Sydney.

*Verdithorax krullii* (Hector) is an allied New Zealand species.

Family AULOPIDAE.

LATROPISCIS, new genus.

Orthotype, *Aulopus milesii* Cuvier & Valenciennes (Hist. Nat. Poiss., xxii., 1849, 519; ed. 2, p. 385. Sydney, N.S. Wales) = *Latropiscis milesii*.

The genus *Aulopus* was first proposed by Cloquet (Dict. Sci. Nat., ed. 2, iii., 1816, suppl., 128. Ex Cuvier MS.) for "*Salmo filamentosus* Bloch," a species which Sherborn was unable to find in Bloch's works and which was perhaps based on a manuscript name. This specific name should apparently therefore be credited to Cloquet, and seems to be a synonym of *Aulopus tirus* (Rafinesque). Cuvier & Valenciennes (Hist. Nat. Poiss., ed. 2, xxii., 1849, 381-385) have given a thorough account of "*Aulopus filamentosus*, Cuv." from the Mediterranean Sea and described a new species, *A. milesii*, from Sydney. The differences between these two forms, as given by those authors, seem to be of generic importance, and I accordingly propose *Latropiscis* for *Aulopus milesii*.

The "Sergeant Baker" of New South Wales (*Latropiscis milesii*) differs in coloration from the Western Australian species (*Latropiscis purpurisatus*) described by Richardson (Icones Piscium, 1843, 6, pl. ii., fig. 3, as *Aulopus*. Houtmans Abrolhos).

Family MYCTOPHIDAE.

Genus NEOSCOPELUS Johnson, 1863.

NEOSCOPELUS BRUUNI, new species.

New name for *Neoscopelus macrolepidotus* McCulloch (Biol. Res. Endeavour, ii., 3, 1914, 90, pl. xvii) from the Great Australian Bight, which is different from *N. macrolepidotus* Johnson (Proc. Zool. Soc. Lond., April 29, 1863, 44, pl. vii.) from Madeira. The Australian form has the ventral fins farther forward, photophores in more regular rows and extending along caudal peduncle, shorter and broader maxillary and less deep body than the figured type of Johnson's species.

Named in honour of my friend, Mr. Anton Bruun, M.Sc., of Copenhagen, in recollection of our pleasant association during the memorable visit of the Royal Danish Research Steamer "Dana" to Australia.

Family SYNGNATHIDAE.

FESTUCALEX, new genus.

Orthotype, *Syngnathus cinctus* Ramsay (Proc. Linn. Soc. N.S. Wales, vii., 1, May 23, 1882, 111. Port Jackson, N.S.W. Type in Austr. Mus. seen) = *Festucalex cincta*.

Operculum with a short keel anteriorly. Snout nearly as long as rest of head. Less than twenty body-rings. Inferior and superior cristae of trunk continuous with those of tail. Median cristae of trunk rectilinear, not joined to others, ending on second or third tail-ring. No tooth-like spines on posterior tail-rings. Ventral surface of trunk flat. Brood-pouch subcaudal, formed by broad lateral flaps extending from behind the rudimentary anal fin for about fourteen tail-rings and reinforced by ribs extending from the margins of the two rows of subcaudal pits which hold the



large eggs. Anus well before middle of length. Dorsal, anal, and caudal fins present.

CAMPICHTHYS, new subgenus of FESTUCALEX.

Orthotype, *Ichthyocampus tryoni* Ogilby (Rec. Austr. Mus., i., 3, July, 1890, 56. Moreton Bay, Queensland. Type in Austr. Mus. seen) = *Festucalex* (*Campichthys*) *tryoni*.

Similar to *Festucalex*, but snout shorter than postorbital portion of head and ventral surface of trunk with a median crista.

FESTUCALEX (CAMPICHTHYS) RUNA, new species.

New name for the Sydney species described and figured by McCulloch (Rec. Austr. Mus., vii., 1909, 318, pl. xc., fig. 1) as *Ichthyocampus filum* which is evidently distinct from that species as Günther (Cat. Fish. Brit. Mus., viii., 1870, 178) united under that name what may be two species, with more body-rings than the Sydney one, from diverse localities. The type-locality of *Ichthyocampus filum* Günther is hereby designated Bay of Islands, New Zealand, so that the Freycinet Harbour form included with it may require a new name.

Subfamily HIPPOCAMPINAE.

FARLAPISCIS, new genus.

Orthotype, *Hippocampus breviceps* Peters (Monatsb. K. pr. Akad. Wiss. Berlin, 1869 (1870), 710. Adelaide, S. Australia) = *Farlapiscis breviceps*.

Head short. Snout  $1\frac{1}{2}$  times diameter of orbit. Coronet high. Twelve or less body-rings. About twenty dorsal rays. Size small, generally less than three inches in length.

A Victorian specimen of *Farlapiscis breviceps* has been figured by McCoy (Prodr. Zool. Vict., dec. vii., 1882, 21, pl. lxx., fig. 2).

This genus also includes the West Australian *Hippocampus tuberculatus* Castelnau (Vict. Offic. Rec. Philad. Exhib., 1875, 48. Swan River). *Hippocampus brevirostris* Woodward (W. Austr. Year-book, 1900-01, i., 1902, 272. *Nomen nudum*. Fremantle. Not *H. brevirostris* Schinz, Das Tierreich (Cuvier) ii., 1822, 262, from Europe) may be designated a synonym of *Farlapiscis tuberculatus* (Castelnau).

I may mention here that *Hippocampus whitei* Bleeker (Verh. Kon. Akad. Wetensch. Amsterdam, ii., 1855, 17, sp. 311) based on the figure of the Hippocampus or Sea-horse in White's Voyage to new South Wales, 1790, is an earlier name for the common Sydney Sea-horse than *Hippocampus novae-hollandiae* Steindachner (Sitzb. Akad. Wiss. Wien, liii., 1866, 474, pl. i., figs. 2a-b. Port Jackson) and must be used in its stead. Bleeker, in the paper quoted, gave an excellent list of Australasian fishes, the forerunner of many later check-lists, but the new names proposed in that list have been generally overlooked. Thus *Platessa jenynsii* Bleeker (*loc. cit.*, p. 15, sp. 265) was introduced for *Platessa* sp. Jenyns (Voy. Beagle, Fish., 1842, 138) so that the Western Australian form of *Pseudorhombus multi-maculatus* Günther (Cat. Fish. Brit. Mus., iv., 1862, 427. Habitat?) may now be known as *Pseudorhombus jenynsii* (Bleeker). *Apistus jenynsii* Bleeker (*loc. cit.*, p. 8, sp. 75), based on *Apistus* sp. Jenyns is, however, evidently a synonym of *Apistus marmoratus* Cuvier & Valenciennes (Hist. Nat. Poiss., iv., November, 1829, 416. "Timor" (Peron); probably Western Australia), a species now known as *Gymnapistes marmoratus*.

Family HEMIRAMPHIDAE.

The Australian garfishes of this family are badly in need of revision, as many extralimital species have been recorded from our waters by various

authors whose identifications seem open to question. The names of the American genera *Hemiramphus* Cuvier, 1816, and *Hyporhamphus* Gill, 1860, have been applied to our species, but seem quite inapplicable, as the genotype of the former is *Esox brasiliensis* Linné, and that of the latter, *Hyporhamphus tricuspidatus* Gill, from Barbadoes. The authentic New South Wales species of "*Hemirhamphus*" in McCulloch's Check-List (1922, 30-31) have been associated with *Hyporhamphus* Gill, with the exception of *H. far*, which is now called *Farhians commersonii* (Whitley, Austr. Zool., vi., August, 1930, 250). For our Sea and River Garfishes, at least, a new generic name is necessary.

#### REPORHAMPHUS, new genus.

Orthotype, *Hemirhamphus australis* Steindachner (Sitzb. Akad. Wiss. Wien, liii., 1, 1866, 48. Port Jackson) = *Reporhamphus australis*.

The genotype is the common Sea Garfish of New South Wales which has been identified, for no apparent reason, as *Hemiramphus intermedius* Cantor, a Chinese species. Steindachner's name evidently applies to our species, which seems distinct from Cantor's. The Victorian form called *Hemirhamphus melanochir* by Cuvier & Valenciennes and well figured by McCoy (Prodr. Zool. Vict., dec. xiv., 1887, pl. cxxxv., fig. 1) may be regarded as a distinct species, *Reporhamphus melanochir*.

#### REPORHAMPHUS ARDELIO, new species.

The River Garfish of New South Wales requires a new specific name as above. It has been called *Hemirhamphus regularis* Günther (Cat. Fish. Brit. Mus., vi., 1866, 261), but the type-locality of that species is hereby designated West Australia, the only definite locality given by Günther, and this leaves the eastern Australian form nameless. The latter has been figured by Stead (Edible Fish. N.S. Wales, 1908, 37, pl. xi.) and may be known as *Reporhamphus ardelio*.

The Sea Garfish (*R. australis*) differs from the River Garfish (*R. ardelio*) in having the origin of the ventrals nearer the hypural joint than the gill-opening; slim body, long upper jaw, and deciduous scales.

#### ARDEAPISCIS, new genus.

Orthotype, *Hemirhamphus welsbyi* Ogilby (Proc. Roy. Soc. Qld., xxi., 1908, 91. Moreton Bay, Queensland) = *Ardeapiscis welsbyi*.

Triangular part of upper jaw wider than long. Lower jaw longer than rest of head. Dorsal origin in advance of anal. Ventrals nearer base of caudal than base of pectoral.

#### Family MONOCENTRIDAE.

##### Genus CLEIDOPUS De Vis, 1882.

##### CLEIDOPUS GLORIAMARIS OCCIDENTALIS, new subspecies.

McCulloch (Rec. Austr. Mus., xiii., 4, April 12, 1921, 124-125) has pointed out that typical eastern Australian specimens of *Cleidopus gloriamaris* De Vis (Proc. Linn. Soc. N.S. Wales, vii., October 28, 1882, 368. Brisbane R., Queensland) have fourteen or fifteen scutes between shoulder and base of tail (De Vis gives 16) whereas Western Australian specimens have thirteen or fourteen, and that the dorsal spines of western specimens are smaller than those of the eastern ones. The Western Australian form may now be subspecifically named *occidentalis*, with McCulloch's Fremantle specimen as holotype.

## Family NOMEIDAE.

Genus NOMEUS Cuvier, 1816.

NOMEUS DYSCRITUS, new species.

D.x/i., 24; A.i/27. P.i/22; V.i/5; C.19. L.lat. 58.

Depth (25 mm.) 4, and head (27.5) 3.6 in length to hypural joint (101). Eye (7) equal to snout (7) and less than interorbital (8). Pectoral (32) longer than head.

Head pointed, profile concave before the eyes. Body compressed, fusiform. Eye large, equal to snout. Two large nostrils on each side. Maxillary not quite reaching vertical of anterior orbital border. Jaws equal, each with a row of small, spaced, curved, pointed teeth; similar teeth on vomer and palatines. Preorbital with a broad free edge, studded with pores. Other pores around chin and piercing scales on top of head. Preopercular angle with radiating serrations, other opercles entire. Head covered, except anteriorly, with weak, thin, cycloid scales.

Body slender and tapering, covered with large, weak, imbricate, cycloid scales. Lateral line commencing on shoulder and running close to and parallel to curve of back and terminating just behind soft dorsal fin; its scales bear tubes and each has its free margin notched. About four rows of scales between lateral line and dorsal fins. Scapula exposed, with radiating ridges.

Dorsal spines weak, the spinous fin fitting into a groove. Soft dorsal and anal with their anterior rays longest, forming lobes. Pectorals very long, with the margins rounded. Ventrals nearly as long as head, fitting into a deep groove on the belly which terminates at the vent just before the anal fin. Caudal very strongly forked, its lobes longer than head. Caudal peduncle much longer than deep.

General colour, in spirit, brownish on back, silvery on belly and sides of head and body. About five large irregular dark brown blotches below the lateral line, with two or three rows of large dark spots below and between them on the flanks. Two similar dark spots at base of caudal. These markings contrast strongly with the silvery ground colour and are almost symmetrical on either side. Caudal lobes dark brown proximally, whitish distally. Cheeks and opercles silvery. A dark brown blotch on each side of the end of the maxillary and another on each interoperculum. The line of demarcation between the dark brown dorsal colour and the silvery lateral and ventral colour is strongly differentiated on the preorbital by an oblique boundary, but on the body the brownish dorsal colour crosses the lateral line and merges into the dark brown blotches. First dorsal blackish; second dorsal and anal whitish, with several dark blotches intruding from the pattern on the body. Axilla and median rays of pectorals blackish. Ventrals black, with a row of interradiat white blotches on the distal half.

Described from the holotype, a specimen 5½ inches in total length, from Shellharbour, New South Wales. Australian Museum registered No. IA., 1928.

*Nomeus dyscritus* was called *Nomeus albula* (Meuschen) in the Australian Check-List (McCulloch, Austr. Mus. Mem., v., 1929, 123), an extralimital species usually called *Nomeus gronovii* (Gmelin) by authors, but that species is American and doubtfully conspecific with the new eastern Australian species named above. For notes on the habits of *Nomeus dyscritus*, see Waite, Rec. Austr. Mus., iv., 1901, 39-41.

## Family POMATOMIDAE.

## Genus POMATOMUS Lacépède, 1803.

## POMATOMUS PEDICA, new species.

New name for *Temnodon saltator* McCoy (Prodr. Zool. Vict., ii, dec. xix., July, 1889, 301, pl. clxxxiii.) which is not *Gasterosteus saltatrix* Linné (Syst. Nat., ed. 12, 1766, 491. Ex Catesby), the type of which, from Carolina, has been remarked upon by Günther (Proc. Linn. Soc. Lond., 1899, 29 and 32). The typical Victorian form of *Pomatomus pedica* has ctenoid scales, seven or eight dorsal spines, and a row of small conical teeth inside the outer row of large ones in the upper jaw. Dr. David Starr Jordan examined specimens in Melbourne, which he stated, in a letter to McCulloch, were deeper in body than the American fish and not so blue.

*Temnodon tubulus* Saville-Kent (Great Barrier Reef, 1893, 369. *Nomen nudum*) is hereby designated a synonym of *Pomatomus pedica*.

## Family SERIOLIDAE.

## Genus NAUCRATES Rafinesque, 1810.

## NAUCRATES ANGELI, new species.

A new name is required for the Pilot Fish of New South Wales as the young forms figured by McCulloch (Rec. Austr. Mus., xv., 1926, 34) differ markedly from Atlantic juveniles of *Naukrates ductor*, recently figured by Roule & Angel (Res. Camp. Sci. Monaco, fasc. lxxix., 1930, 86, pl. v., figs. 111-114). The holotype of my new species is the larger specimen figured by McCulloch from Maroubra, New South Wales, and the specific name is given in honour of M. Fernand Angel, whose delineations of the young fishes taken by the late Prince of Monaco's expeditions are superb examples of ichthyological draughtsmanship.

## REGIFICOLA, new genus.

Orthotype, *Seriola grandis* Castelnau (Proc. Zool. Acclim. Soc. Vict., i., July 15, 1872, 115. Melbourne Market) = *Regificola grandis*.

Teeth in broad villiform bands on jaws, vomer, and palatines. Dorsal and anal lobes falcate, not produced. Fin-formula generally D.vii., i/34; A.ii., i/21. The more elongate body of the type-species shows immediately that it cannot be congeneric with *Caranx dumerili* Risso (Ichth. Nice, 1810, 175. Mediterranean. Figured by Cuv. & Val., pl. clviii), the logotype of *Seriola* Cuvier, selected by Jarocki (*vide* Sherborn, Index Anim.). The typical form of *Regificola grandis* has been figured by McCoy (Prodr. Zool. Vict., ii., dec. xviii., May, 1889, 263, pl. clxxii).

## Family CARANGIDAE.

## USACARANX, new genus.

## USACARANX NOBILIS (Macleay).

The New South Wales Trevally which has been called *Caranx georgianus* Cuvier & Valenciennes (Hist. Nat. Poiss., ix., March, 1833, 85. King George's Sound, W. Australia) by authors is not that species, but must apparently be known as *Usacaranx nobilis* Macleay (Proc. Linn. Soc. N.S. Wales, v., 4, May 20, 1881, 532, as *Caranx*. Port Jackson. Type in Macleay Museum, University of Sydney), the genotype of my new genus. Messrs. Troughton, Grant, and Wright collected a typical specimen of *Usacaranx georgianus* at Albany, King George's Sound, in November, 1921. This specimen has depth (68) nearly 3.2 in length to end of middle caudal rays (217); head (62) 3.3 in same; about 47 scutes; upper profile of head evenly



rounded. Another Western Australian specimen has been figured by McCulloch (Biol. Res. Endeavour, iii., 1915, 126, pl. xx), but he confused eastern and western Australian species in his description. A fine specimen collected by Mr. J. H. Wright, at Sans Souci, Botany Bay, New South Wales, in February, 1916, has depth (115) nearly 2.8 in length (320); head (96) 3.3 in same; more than 50 scutes, the anterior of which ascend the curved portion of the lateral line more than in W. Australian specimens. The snout is slightly concave before the eyes, but in a second Botany Bay specimen, caught at the same time, this concavity is much more pronounced, and the upper part of the head is gibbous. This form has been called *Caranx nobilis* by Macleay, and his name is therefore available for the New South Wales species confused with *C. georgianus*. Specimens from Lord Howe Island appear to be conspecific with the Sydney ones.

USACARANX GEORGIANUS WRIGHTI, new subspecies.

Specimens from South Australia, identified in the Australian Museum as *Caranx georgianus*, have depth (42) 2.9 in length (124); head (37) 3.3 in same; less than 40 scutes on straight portion of lateral line, the anterior portion of which is more strongly curved than it is in typical *Usacaranx georgianus*; upper profile of head oblique, gently curved.

Holotype (Austr. Mus., registered No. I.10336) from 40 miles west of Kingston, South Australia, 30 faths.; "Endeavour," August, 1909.

Mr. J. H. Wright, after whom the new subspecies is named, has presented many interesting specimens of Botany Bay fishes to the Australian Museum and drew the attention of the late A. R. McCulloch and myself to the curious development of the head in some of the New South Wales specimens of *Usacaranx nobilis*.

Family SCIAENIDAE.

ZELUCO, new genus.

Orthotype, *Otolithus atelodus* Günther (Ann. Mag. Nat. Hist. (3), xx., July 1, 1867, 60. Australia. Type in Brit. Museum) = *Zeluco atelodus*.

Precaudal vertebrae more numerous than the caudal ones. No true canine teeth in either jaw. Caudal fin emarginate.

The type-species of this genus has been admirably reviewed by Ogilby (Mem. Qld. Mus., vi., 1918, 67).

Family MULLIDAE.

BARBUPENEUS, new genus.

Orthotype, *Upeneus signatus* Günther (Ann. Mag. Nat. Hist. (3), xx., July 1, 1867, 59. Port Jackson, New South Wales. Type in British Museum) = *Barbupeneus signatus*.

Maxillary not quite reaching to below eye. Vomer and palatines toothless. A single row of teeth in jaws. Scales extending along top of head to level of nostrils.

Near *Hogbinia* Whitley (Proc. Linn. Soc. N.S. Wales, liv., 1929, 92. Orthotype, *Upeneus filamentosus* Macleay), but head not so elongate and snout shorter.

CAPRUPENEUS, new genus.

Orthotype, *Pseudupeneus jeffi* Ogilby (Proc. Roy. Soc. Qld., xxi., August, 1908, 19. Brisbane R., Queensland) = *Caprupeneus jeffi*.

Maxillary almost reaching vertical of anterior orbital margin. Teeth on jaws, vomer, and palatines. Head scaly in advance of nostrils. Dark oblique bars on caudal fin.

Near *Upeneoides* Bleeker (Verh. Bat. Gen., xxii., 1849, Percoid., 5, 6, 26, and 63. Logotype, *Mullus vittatus* (Forsk.) Bonnaterre), but has head larger in proportion to the much deeper body.

I may record here that Bloch & Schneider (Syst. Ichth., 1801, 78) described *Mullus surmuletus* var. *lineatus* from New Holland, evidently collected by Dr. Latham at Port Jackson or Botany Bay, New South Wales. They also called this species *Mullus latamii* on plate xviii. of their work, and these two names, hitherto overlooked, apply to the Sydney species which I (Rec. Austr. Mus., xvii., 1929, 124, pl. xxxi., fig. 2) tentatively regarded as *Upeneichthys porosus* (Cuv. & Val.) from New Zealand. The Blue-Striped Goatfish of New South Wales may now be known as *Upeneichthys lineatus* (Bloch & Schneider).

#### Family SPARIDAE.

##### ROUGHLEYIA, new genus.

Orthotype, *Chrysophrys australis* Günther (Cat. Fish. Brit. Mus., i., 1859, 494. Type-locality: Port Jackson, New South Wales, by present designation) = *Roughleyia australis*.

Two of the commonest and best known species of fishes in New South Wales present taxonomic difficulties when their correct scientific names are sought. The first is the Black Bream, called *Sparus australis* by authors, and the second is the Snapper, generally known as *Pagrosomus auratus*. Günther described *Chrysophrys australis* from diverse Australian localities, so, to afford a foundation for future studies, I designate Port Jackson as type-locality so as to preserve the specific name for our form. This species is not, however, a *Chrysophrys*, as the authors of that generic name, Quoy & Gaimard (Voy. Uranie & Physicienne, Zool., 1824, 299. *Ex* Cuvier MS. Haplotype *C. unicolor* Quoy & Gaimard) describe it as being rosy ("d'un rose tendre") in colour, whereas the Black Bream is neither pink nor red. Most modern authors have placed Günther's species in the genus *Sparus* Linné (Syst. Nat., ed. 10, 1758, 277; ed. 12, 1766, 467. *Ex* Artedi). There are twenty-two "foundation members" of this genus, none of which is tautonymic, so that the question of first type-designation arises. The first selection of a logotype for *Sparus* appears to be that of Jordan & Gilbert (Bull. U.S. Nat. Mus., iii., 16, 1882, 555) who chose the first species, *Sparus auratus* [sic] Linné. Lesson (Dict. class. d'Hist. Nat., xv., 1829, 522) made *Sparus aurata* Linné the type of the "sous-genre Daurade" of Cuvier [1816, vernac.] = *Chryseis* Schinz (Das Thierreich (Cuvier), 1822, 438) so that *Chryseis*, a genus which has been generally overlooked, becomes an absolute synonym of *Sparus*. Other synonyms are *Aurata* Cloquet (Dict. Sci. Nat., xii., 1818, 546. Orthotype, *Sparus aurata* Linné. *Aurata* Oken, Isis., 1817, 1182a is a *nomen nudum*; teste T. Iredale), *Dorada* Jarocki (Zoologia, iv., 1822, 200. Tautotype, *Sparus aurata* Gmelin [*fide* Sherborn] and ? *Daurada* Stark, 1828), and *Eudynamia* Gistel (Nat. Thier., 1848, xiii. Haplotype, *Chrysophrys aurata* ibid., 108. Not *Eudynamys* Vigors & Horsfield, 1826—Aves), whereas *Chrysophrys* Quoy & Gaimard, 1824 (not *Chrysophris* Cuvier, 1829) remains distinct.

*Chrysophrys australis* Günther differs from *Sparus aurata* Linné in having less dorsal and anal rays, much fewer scales on lateral line (less than 50 instead of more than 70) and larger scales on body generally. Thus the Australian Black Bream requires a new generic name, and I have much pleasure in naming it *Roughleyia*, after my friend Mr. T. C. Roughley, in whose book, "Fishes of Australia and Their Technology," the species under discussion will be found excellently described and illustrated.

I have noted above that the generic name *Chrysophrys* applies better to the Snapper than to the Bream (*Roughleyia*) and will now discuss the taxonomy of the eastern Australian Snapper. I have not examined Western Australian or New Zealand specimens, but strongly suspect that our New South Wales form is specifically distinct from the snappers of those regions. The typical New Zealand form is *Chrysophrys auratus* (Bloch & Schneider) and the Western Australian species is *Chrysophrys unicolor* Quoy & Gaimard. Bloch & Schneider derived their specific name from *Sciaena aurata* Forster MS., but this must not be confused with the distinct species later described by Lichtenstein (Doublet. Z.M. Berlin, 1823, 116) from Brazil under the same name. Furthermore, Bloch & Schneider's name in its present combination invalidates *Chrysophris aurata* Cuvier (Règne Anim., ed. 2, ii., 1829, 182) which must be known as *Sparus aurata* Linné.

The first name which may be applied to the New South Wales Snapper appears to be *Pagrus guttulatus* Cuvier & Valenciennes (Hist. Nat. Poiss., vi., 1830, 160) and, so as to enable that name to be used for our species, I hereby designate Jervis Bay, New South Wales, the type-locality of the species, and our Snapper will thus be known as *Chrysophrys guttulatus* (Cuv. & Val.).

The Tarwhine of New South Wales, another Sparoid, has usually been called *Sparus sarba* Forskal (Descr. Anim., 1775, xi. & 31), but seems to be distinct from that Red Sea species, the authorship of which should be credited to Gmelin, as Forskal's work is non-binomial. Our form has been well characterised and figured by Stead (Ed. Fish. N.S. Wales, 1908, 78, pl. xvii.), and may be known as *ROUGHLEYIA TARWHINE*, new species.

#### Family SCORPIDAE.

##### Genus ATYPICHTHYS Günther, 1862.

##### ATYPICHTHYS MADO, new species.

This is the Peronian representative of *Atypus strigatus* Günther (Cat. Fish. Brit. Mus., ii., 1860, 64 & 518. Raoul Island, Kermadec Group; Swan River, W. Australia; Holdfast Bay, S. Australia; Erromanga, New Hebrides) which has been well figured by Steindachner (Sitzb. Akad. Wiss. Wien., liii., 1866, 435, pl. iv., fig. 2).

The smaller scales of *Atypichthys mado* distinguish it from Günther's species, the description of which appears to be a composite one, based on specimens, probably not conspecific, from diverse localities. To serve as a basis for future research, I designate Raoul Island the type-locality of *Atypus strigatus* Günther.

The holotype of *Atypichthys mado* is a specimen a little over five inches long, in the Australian Museum (No. I.4334), from Manly, New South Wales.

#### Family KYPHOSIDAE.

##### SEGUTILUM, new genus.

Orthotype, *Pimelepterus sydneyanus* Günther (Ann. Mag. Nat. Hist. (5), xviii., November 1, 1886, 368. Port Jackson, N.S. Wales. Type in British Museum) = *Segutilum sydneyanum*.

Profile of head evenly sloping or rounded, without gibbosities. Body deep, compressed. Ten or eleven dorsal spines. Scales extending over fins, with the exception of ventrals and spinous dorsal and anal. Caudal excavate, but not strongly forked.

Differs from *Pimelepterus* Lacépède (Hist. Nat. Poiss., iv., 1802, 429. Haplotype, *P. bosquii* Lacépède) in having fewer dorsal and anal rays and

shorter ventrals and from *Kyphosus* Lacépède (Hist. Nat. Poiss., iii., 1802, 114. Haplotype, *K. bigibbus* Lacépède) in lacking the gibbous profile and in having fewer dorsal spines.

SEGUTILUM KLUNZINGERI, new species.

*Pimelepterus indicus* Klunzinger, Sitzb. Akad. Wiss. Wien., lxxx., 1, 1879, 357, pl. vii.

Klunzinger's species is not *P. indicus* Cuvier & Valenciennes (Hist. Nat. Poiss., vii., 1831, 270. Ex Kuhl & van Hasselt MS. No loc.) as has been noted by McCulloch (Rec. Austr. Mus., xiii., 1920, 56) who has regarded Klunzinger's record as referable to *Kyphosus sydneyanus*, but it is unlikely that this restricted New South Wales species recurs in Western Australia. The type of this new species is the specimen figured on Klunzinger's plate by Konopicky, and the type-locality is King George's Sound.

LEPTOKYPHOSUS, new subgenus of SEGUTILUM.

Orthotype, *Kyphosus gibsoni* Ogilby (Mem. Qld. Mus., i., 1912, 50. Moreton Bay, Queensland. Type in Queensland Museum) = *Segutylum (Leptokyphosus) gibsoni*.

Form more slender than in *Segutylum*, and soft dorsal fin longer.

Ogilby's type was redescribed and figured by McCulloch (Rec. Austr. Mus., xiii., 1920, 59, pl. xii., fig. 3).

The species from northern Australia called *Kyphosus cinerascens* by Australian authors would be better known as *Opisthistius squamosus* (Alleyn & Macleay).

Family GIRELLIDAE.

GIRELLIPISCIS, new genus.

Orthotype, *Girella elevata* Macleay (Proc. Linn. Soc. N.S. Wales, v., 3, February, 1881, 408. Port Jackson) = *Girellipiscis elevatus*.

Outer teeth of jaws in single rows. Nostrils fimbriate. Thirteen dorsal spines.

Differs in these characters from *Girella* Gray (Illustr. Ind. Zool., ii., February, 1835, pl. xcvi.; *vide* Sherborn, Ind. Anim.) as described by Jordan & Thompson (Proc. U.S. Nat. Mus., xli., 1912, 589). According to these authors the typical *Girella punctata* Gray has 15 dorsal spines and 50 or more transverse series of scales. The Australian Blackfish, which has been admirably described and figured by McCulloch (Rec. Austr. Mus., xiii., 1920, 62, pl. xiv., fig. 1), has less than 50 scales in lateral line and may be called *Girella (Incisidens) tricuspidata* from Western Australia and *Girella (Incisidens) triglyphus* from eastern Australia, the subgeneric name having been applied to a female of the latter species by Gill (Proc. Acad. Nat. Sci. Philad., xiv., 1862, 244. Haplotype, *Crenidens simplex* Richardson).

*Girella zonata* Günther may not be Australian and seems to approach *Girella mezinga* Jordan & Starks (Proc. U.S. Nat. Mus., xxxii., 1907, 496, fig. 3) from the Riu Kiu Islands.

I have not seen the original descriptions of *Girella castelnaui* Thomiot, *Doidyxodon australis* Thomiot, or *Tilodon australis* Thomiot, although abstracts of the last two species have been given by Fowler & Bean (Bull. U.S. Nat. Mus., 100, viii., 1929, 9-11) and show that they are probably not members of the family Girellidae; furthermore, the generic name *Doidyxodon* is apparently preoccupied.

IREDALELLA, new genus.

Orthotype, *Girella cyanea* Macleay (Proc. Linn. Soc. N.S. Wales, v., 3, February, 1881, 409. No loc.) = *Iredalella cyanea*.



Outer teeth of jaws in single rows. Nostrils scarcely fimbriate. More than thirteen dorsal spines. Ground-colour blue.

Named after Mr. Tom Iredale, who has collected an allied species of Bluefish in the Kermadec Islands.

Family CHAETODONTIDAE.

Genus VINCULUM McCulloch, 1914.

VINCULUM KERSHAWI, new species.

The Victorian specimen figured by McCulloch (Biol. Res. Endeavour, ii., 1914, 110, pl. xxii.) as *Vinculum serfasciatum* (Richardson) is not that Western Australian species. Richardson (Ann. Mag. Nat. Hist., x., September 1, 1842, 26) described *Chaetodon serfasciatus* as having the curve of the back springing boldly from the middle of the orbit, eye touching profile, serrations scarcely perceptible on lower limb of preoperculum, and 16 or 17 anal rays. The form figured by McCulloch has the curve of the back originating over posterior half of orbit, eye not reaching profile, lower limb of preoperculum serrated, and 18 anal rays. The disposition of the transverse bands does not quite correspond with Richardson's description of the colour-markings.

In view of these discrepancies, I name the Victorian species in honour of Mr. J. A. Kershaw, of the National Museum, Melbourne, the author of numerous articles on the fishes of Victoria.

Family CHIRONEMIDAE.

Genus CHIRONEMUS Cuv. & Val., 1829.

CHIRONEMUS ABORIGINALIS, new species.

Ogilby (Edible Fish. N.S. Wales, 1893, 54, pl. xvii.) and Roughley (Fish. Austr., 1916, 121, pl. xxxix.) have given good descriptions and figures of the New South Wales species generally called *Chironemus marmoratus* Günther (Cat. Fish. Brit. Mus., ii., 1860, 76). That species was described from Swan River, Western Australia (type-locality) and "Darnley Island," but the latter locality is probably incorrect. The New South Wales form may be named *C. aboriginalis*, as it has the sixth dorsal spine longest, generally 2.25 to 2.5 in head, and the height of body more than length of head.

Family ISTIOPHORIDAE.

ISTIOMPAX AUSTRALIS, new genus and species.

The holotype of the new species, which is also the orthotype of the genus, is the specimen figured by Ramsay (Proc. Linn. Soc. N.S. Wales, v., February, 1881, 295 & 522, pl. viii. Off Wollongong, New South Wales) as *Histiophorus gladius*. This specimen is mounted in the Australian Museum. I have also examined a fresh specimen of this novelty from Manly, near Sydney, and have made detailed notes and measurements with a view to future publication. Australasian authors have apparently also misidentified this species as *Tetrapturus indicus* and *Makaira mazara*.

Family TEUTHIDAE.

BUROBULLA, new genus.

Orthotype, *Xesurus maculatus* Ogilby (Proc. Zool. Soc. Lond., October 1, 1887, 395. Port Jackson, New South Wales) = *Burobulla maculata*.

Differs from *Xesurus* Jordan & Evermann (Rept. U.S. Comm. Fish., 1895, Append., v., December 28, 1896, 421. Orthotype, *Prionurus punctatus* Gill) in having D.ix/24 and the body light-spotted.

## Family BOTHIDAE.

## ISTIORHOMBUS, new genus.

Orthotype, *Pseudorhombus spinosus* McCulloch (Biol. Res. Endeavour, II., July 3, 1914, 129, pl. xxv. Houtman's Abrolhos (type) and between Cape Naturaliste and Geraldton, W. Australia. Type on deposit in Australian Museum) = *Istiorhombus spinosus*.

Profile not notched before the eye. Gill-rakers palmate, as long as broad. Scales cycloid on both sides of the body. Dorsal originating before nostrils on blind side of body. A strong preanal spine.

*Pseudorhombus spinosus* Norman (Biol. Res. Endeavour, v., June 15, 1926, 224. Queensland specimens only) differs in details of squamation from the true Western Australian species of McCulloch and may be named

## ISTIORHOMBUS SPINOSUS NORMANI, new subspecies.

Whilst on the subject of *Pseudorhombus*, I take this opportunity of inserting a figure (plate xxv) of the holotype of *Pseudorhombus anomalus* Ogilby (Mem. Qld. Mus., i., November 27, 1912, 48. Moreton Bay, Queensland), which has been very kindly lent to me by the Director of the Queensland Museum. Ogilby's description is very accurate, but I find from microscopical examination that the fin-formula is D.68 and A.54. This species is apparently a true *Pseudorhombus*.

I also take this opportunity to propose CHOPINOPSETTA as a new name for the extra-Australian genus *Eucitharus* Gill (Proc. U.S. Nat. Mus., xi., 1889, 600) preoccupied by *Eucithara* Fischer, 1883, a genus of mollusca.

## Family SYNAPTURIDAE.

## PARADICULA, new genus.

Orthotype, *Synaptura setifer* Paradise and Whitley (Mem. Qld. Mus., ix., 1, April 28, 1927, 91 & 101, fig. 3. Port Darwin, North Australia) = *Paradicula setifer*.

*Whitleyina* Fowler & Bean (Bull. U.S. Nat. Mus., 100, x., publ. early 1930, vii. & 163) is a synonym of *Whitleyia* of the same authors (*loc. cit.*, 2 & 148) which has line-priority. Unfortunately, this genus of Chandid fishes preoccupies *Whitleyia* Chabanaud (Bull. Inst. Oceanogr., No. 555, July 5, 1930, 2, 8 & 16) introduced a little later for a genus of soles. Whilst thanking these authors for the dual honour thus conferred, the writer feels it is necessary to take this early opportunity of renaming Chabanaud's genus, and accordingly proposes the new generic name *Paradicula*, in honour of his late friend and collaborator, W. E. J. Paradise, with *Synaptura setifer* as orthotype.

Some Bleekerian species of Soles, none of them yet known authentically from Australia, require new generic names. *Achirus poropterus* Bleeker, 1851, has between sixty and seventy dorsal rays and between forty and fifty anal rays, and has fewer scales than *Pardachirus*. This species may be made the type of the new genus NORMANETTA, named after Mr. J. R. Norman. *Synaptura panoides* Bleeker, 1851, may be called CHABANAUDETTA a new name in honour of M. Paul Chabanaud, which will replace *Anisocheirus* Günther, twice preoccupied. For *Dexillus* Chabanaud, 1930, preoccupied by *Dexilla* Westwood, 1840, a genus of Diptera, I propose the new generic name DEXILLICHTHYS, with *Synaptura macrolepis* Bleeker, 1858, as genotype.

## Family CORIDAE.

## CTENOCORISSA, new genus.

Orthotype, *Labrus pictus* Bloch & Schneider (Syst. Ichth., 1801, 251, pl. iv. "Habitat in America australi ad Novam Hollandiam." Type-locality, Botany Bay, New South Wales, by present designation).

The characteristic comb-shaped band on each side is sufficient to distinguish this species generically from all other species allied to *Coris* Lacépède known to the writer. The "Banana Fish" or "Comb Fish" is commoner at Lord Howe Island than around Sydney, but the type, collected by Dr. Latham, evidently came from the Botany Bay district, where I have collected it also. The species may now be known as *Ctenocorissa picta*.

## Family CALLIONYMIDAE.

## REPOMUCENUS, new genus.

Orthotype, *Callionymus calcaratus* Macleay (Proc. Linn. Soc. N.S. Wales, v., 4, May 20, 1881, 628. Port Jackson, New South Wales) = *Repomucenus calcaratus*.

Preopercular spine with its distal extremity curved upward and with several recurved hooks on its upper surface, and with an antrorse spine below. First dorsal spine not longer than second. Dorsal rays mostly simple. Inner ventral ray joined to base of pectoral by a broad membrane which covers the bases of the lower pectoral rays.

## FOETOREPUS, new genus.

Orthotype, *Callionymus calauropomus* Richardson (Zool. Voy. Erebus & Terror, Fish., 1844, 10, pl. vii., figs. 4-5. Western Australia).

Similar to *Repomucenus*, but has no antrorse barb below preopercular spine and the dorsal rays mostly branched; preopercular spine with two distal hooks. *Foetorepus calauropomus* has shorter snout and narrower interorbital than *F. achates* (De Vis) from Queensland, whilst the Victorian *F. papilio* (Günther) has 6 anal rays instead of 7 or 8.

## Family BLENNIIDAE.

## Subfamily CLININAE.

## Genus PETRAITES Ogilby, 1885.

## PETRAITES SELLULARIUS, new species.

New name for *Petraites roseus* McCulloch (Rec. Austr. Mus., vii., 1908, 40, pl. x., fig. 4), from New South Wales (type) and Lord Howe Island, which differs from *Cristiceps roseus* as described by Günther (Cat. Fish. Brit. Mus., iii., 1861, 274), from Freycinet's Harbour (type) and "New Guinea and Islands," in having the height  $4\frac{1}{2}$  in total length and the eye longer than the snout. Probably direct comparison of specimens would reveal further differences. This species is common around Sydney, the type-locality.

## Subfamily BLENNIINAE.

## Genus PICTIBLENNIUS Whitley, 1930.

## PICTIBLENNIUS IREDALEI, new species.

New name for *Blennius castaneus* Macleay (Proc. Linn. Soc. N.S. Wales, vi., 1, July, 1881, 5. Port Jackson) preoccupied by *Blennius castaneus* Castelnau (Mem. Poiss. Afr. Austr., 1861, 50, *fide* Barnard, Ann. S. Afr. Mus., xxi., 1927, 837) from South Africa. This New South Wales species is allied to *Pictiblenius tasmanianus* (Richardson) and *P. intermedius* (Ogilby), the foundation members of my genus (Mem. Qld. Mus., x., 1930, 19).

Named after Mr. Tom Iredale, conchologist of the Australian Museum, who collected a series of this species in marine growths on submerged timber at Clark Island, Port Jackson, in April, 1928; it was not found at numerous other stations visited in Port Jackson at the same time.

#### Subfamily TRIPTERYGIONTIDAE.

This subfamily includes Blennies with large scales and three dorsal fins. The genera *Lepidoblennius* Steindachner, 1867, and *Helcogramma* McCulloch & Waite, 1918, may be tentatively included, but these forms have a complete lateral line.

#### VAUCLUSELLA, new genus.

Orthotype, *Tripterygium annulatum* Ramsay & Ogilby (Proc. Linn. Soc. N.S. Wales (2), ii., 4, March 21, 1888, 1021. Vaucuse, Port Jackson. Type in Austr. Mus.) = *Vauchusella annulata*.

Snout pointed. Head naked; only one or two scales before first dorsal spine. Gill-membranes united across isthmus. Gill-openings very broad. Bands of minute pointed teeth in jaws. No canines.

Body elongate, tapering, covered with large ctenoid scales, in less than 40 transverse series. The tube-bearing anterior portion of the lateral line does not reach level of third dorsal fin and is separated by one row of scales from the posterior portion, which consists of notched scales. Three dorsal fins, close together; 3 + 12 spines. No produced spines or rays. Upper pectoral rays simple, median bifurcate. Lower pectoral rays and ventral and anal rays finger-like. Caudal truncate or gently rounded, its rays branched. Coloration variable, but without well-marked transverse bands.

Differs from *Tripterygion* Risso (Hist. Nat. Eur. Mérid., iii., 1826, 241. Haplotype, *T. nasus* Risso) in having the dorsal fins closer together and without produced rays. *Enneapterygius* Rüppell (Neue Wirbelth. Abyssin. Fische, 1835, 2. Orthotype, *E. pusillus* Rüppell) has less than thirty transverse series of scales and higher dorsal fins. *Notoclinops* Whitley (Mem. Qld. Mus., x., 1, August 28, 1930, 20. Orthotype, *Tripterygion segmentatum* McCulloch & Phillipps) is nearer *Vauchusella*, but has well marked transverse bands on body. Waite (Rec. Canterb. Mus., ii., 1, December, 1913, 1-16, pls. i.-v.) has given an excellent revision of the New Zealand relatives of *Tripterygion*, but none of his species seems to be referable to that genus, and it seems likely that several new generic names will have to be given to the New Zealand species.

#### VERCONNECTES, new genus.

This genus differs from those mentioned above in the form of the head, backward extension of the mouth, and the very long anterior portion of the lateral line. *Tranectes* McCulloch & Waite (Rec. S. Austr. Mus., i., 1, May 24, 1918, 53. Orthotype, *T. bucephalus* McCulloch & Waite) may be regarded as preoccupied by *Trinectes* Rafinesque (The Atlantic Journal and Friend of Knowledge, i., 1832, reproduced by Chabanaud, Bull. Mus. Hist. Nat. Paris (2), ii., 3, 1930, 260. Ex Myers MS.) of the same etymological derivation; I therefore rename it *Verconnectes*, and the type-species may now be known as *Verconnectes bucephalus*.

Named after Sir Joseph Verco, the veteran South Australian conchologist, who has conducted extensive dredging operations in our southern waters.



## Family GOBIESOCIDAE.

## PARVICREPIS, new genus.

Orthotype, *Diplocrepis parvipinnis* Waite (Rec. Austr. Mus., vi., 3, June 19, 1906, 202, pl. xxxvi., fig. 3. New South Wales; i.e., Sydney district) = *Parvicrepis parvipinnis*.

Günther (Cat. Fish. Brit. Mus., iii., 1861, 490 & 506) proposed the genus *Diplocrepis* for *Lepadogaster puniceus* Richardson (Zool. Voy. Erebus & Terror, Fish., 1846, 71, pl. xliii., figs. 1-7. New Zealand). On comparing *Diplocrepis parvipinnis* Waite with Richardson's figure, I find the differences are so striking that it is evident that the Australian species hitherto known as *Diplocrepis* are not congeneric. *Parvicrepis* may be thus defined:—

Head strongly depressed. Gill-membranes united across isthmus. Rows of small pointed teeth in jaws, no incisors. Upper jaw much longer than lower. Body more elongate than in *Diplocrepis* and with longer caudal peduncle. Ventral sucker not nearly stretching across ventral surface of body; anterior margin of the posterior portion of the sucker free.

## VOLGIOLUS, new subgenus of PARVICREPIS.

Orthotype, *Diplocrepis costatus* Ogilby (Proc. Linn. Soc. N.S. Wales, x., 2, July 31, 1885, 270. Port Jackson) = *Parvicrepis (Volgiolus) costatus*.

Dorsal and anal fins with an increased number of rays and much nearer the caudal fin than in typical *Parvicrepis*.

## Family ELEOTRIDAE.

## MEUSCHENULA, new genus.

Orthotype, *Agonostoma darwiniense* Macleay (Proc. Linn. Soc. N.S. Wales, ii., 4, June, 1878, 360, pl. ix., fig. 8. Port Darwin, North Australia) = *Meuschenula darwiniensis*.

Preopercular margins free and exposed. No supraciliary scales. More than thirty scales between pectoral axil and hypural joint. Light spots on soft dorsal and caudal fins.

A co-type, which is hereby designated the lectotype, of Macleay's species, preserved in the Australian Museum, has been described in detail by McCulloch & Ogilby (Rec. Austr. Mus., xii., 10, July 14, 1919, 277).

## Family PERIOPHTHALMIDAE.

## Genus EUCHORISTOPUS Gill, 1863.

The genotype of *Periophthalmus* Bloch & Schneider (Syst. Ichth., 1801, 63) is *P. papilio*, figured on plate 14. This species has a high and expansive anterior dorsal fin and is quite unlike the Australian form hitherto regarded as congeneric. Gill (Proc. Acad. Nat. Sci. Philad., 1863, 271) proposed the name *Euchoristopus* for *Periophthalmus koeltreuteri* (Pallas). He seems to have subtitled the definition of his new genus *Periophthalmus* instead of *Euchoristopus*, as he evidently intended, but, nevertheless, *Euchoristopus* is the more applicable name for the Australian form.

## EUCHORISTOPUS KALOLO (Lesson).

*Periophthalmus kalolo* Lesson, Voy. Coquille, Zool., ii., 1, 1831, 146. Waigiou. *Periophthalmus argentilineatus* Cuvier & Valenciennes, Hist. Nat. Poiss., xii., 1837, 191. Waigiou (Lesson & Garnot). *Id.* Harms, Zeit. Wiss. Zool., cxxxiii., 1929, 243 *et seq.*, pls. vi.-vii. & text-figs. 19 *et seq.* *Id.* Eggert, *ibid.*, 400 & 404, pls. viii.-ix.

*Periophthalmus koeltreuteri* var. *argentilineatus* McCulloch & Ogilby, Rec. Austr. Mus., xii., 10, 1919, 194. Queensland specimens only; not figure.

I have collected this fish in several Queensland localities. It is common in mangrove swamps and has been commented upon by naturalists

since the time of Cook. *P. koelreuteri* (Pallas) is apparently an Indian or African relative, so I am using Lesson's name, which has priority over that of Cuvier & Valenciennes, for the Queensland species. Harms (*loc. cit., supra*) has demonstrated the existence of local varieties of "*Periophthalmus argentilineatus*," and it is probable that these deserve distinct varietal designations. It is not my intention to name them here, but I take this opportunity of separating the north-western Australian form, as follows.

*EUCHORISTOPUS KALOLO REGIUS*, new subspecies.

*Periophthalmus koelreuteri* var. *argentilineatus* McCulloch & Ogilby, Rec. Austr. Mus., xii., 10, July 14, 1919, 194, pl. xxxi., fig. 1. King Sound specimens only. Not *P. argentilineatus* Cuv. & Val.

*Periophthalmus koelreuteri* Rendahl, Medd. Zool. Mus. Kristiania, v., September 8, 1922, 165 & 191. Roebuck Bay and Daly River. Not *P. koelreuteri* (Pallas).

The holotype of this subspecies is the Australian Museum specimen figured by McCulloch & Ogilby from King Sound, north-western Australia. It differs from my Queensland specimens in having the first dorsal fin more emarginate and the caudal more evenly rounded.

Family GOBIIDAE.

Genus *MUCOGOBIUS* McCulloch, 1912.

*MUCOGOBIUS GOBIOSOMA*, new species.

South-western Australian specimens called *Callogobius hasseltii* var. *mucosus* by McCulloch & Ogilby (Rec. Austr. Mus., xii., 10, July 14, 1919, 217) differ in squamation and coloration from *Gobius mucosus* Günther (Proc. Zool. Soc. Lond., 1871 (May 2, 1872), 663, pl. lxiii., fig. a) from Adelaide, South Australia and from *Gobius depressus* Ramsay & Ogilby (Proc. Linn. Soc. N.S. Wales (2), i., 1, May 25, 1886, 4 and Ogilby, Cat. Fish. N.S. Wales, published about August 25, 1886, 35) from Port Jackson, New South Wales, and may be renamed *Mucogobius gobiosoma*.

Family SCORPAENIDAE.

*RUBORALGA*, new genus.

Orthotype, *Scorpaena jacksoniensis* Steindachner (Sitzb. Akad. Wiss. Wien, liii., 1, 1866, 438, pl. iii., figs. 2-2a. Port Jackson, N.S.W.) = *Ruboralga jacksoniensis*.

Orbital crests and bony stay of cheek with several spines. Lower part of operculum naked. Palatine and vomerine teeth present. Twelve dorsal spines, none of them greatly produced, and all united by membrane for the greater part of their length. Second anal spine longer than third. General coloration mainly reddish.

*Scorpaena* Linné (Syst. Nat., ed. 10, 1758, 266; ed. 12, 1766, 452. Logotype, *S. porcus* selected by Jordan & Gilbert, Bull. U.S. Nat. Mus., iii., 16, 1882, 678) from the Mediterranean Sea seems to have a very different facies when Bloch's plate 181 of the typical species is compared with the Australian form.

With the new genus *Ruboralga* may be associated *Scorpaena ergastulorum* Richardson, *Scorpaena sumptuosa* Castelnau, and *Scorpaena bellinosa* Castelnau from Australia and *Scorpaena cardinalis* Richardson from New Zealand.

Family PLATYCEPHALIDAE.

*CACUMEN*, new genus.

Orthotype, *Platycephalus speculator* Klunzinger (Arch. Naturg., xxxviii., 1, 1872, 28. Hobson's Bay, Victoria) = *Cacumen speculator*.

The large orbits and scaly interorbital and nape characteristic of the type-species of this genus are well shown in Klunzinger's figure (Sitzb. Akad. Wiss. Wien, lxxx, 1, 1879, pl. iv., fig. 1).

PLANIPRORA, new genus.

Orthotype, *Platycephalus fuscus* Cuvier & Valenciennes (Hist. Nat. Poiss., iv., November, 1829, 241. Port Jackson) = *Planiprora fusca*.

Head and body very broad and depressed. Interorbital sunken, broader than transverse diameter of eye. Scales small. Body dark, without conspicuous dark spots. Ventrals, caudal, and lower part of pectoral fins blackish with white borders.

LEVIPRORA, new genus.

Orthotype, *Platycephalus inops* Jenyns (Zool. Voy. Beagle, Fish., 1840, 33. King George's Sound, W. Australia) = *Leviprora inops*.

No exposed bony ridges on upper surface of cranium. Eye larger than interorbital.

TRUDIS, new genus.

Orthotype, *Platycephalus bassensis* Cuvier & Valenciennes (Hist. Nat. Poiss., iv., November, 1829, 247. Westernport, Victoria) = *Trudis bassensis*.

Lower preopercular spine considerably longer than upper. Pectorals small. Scales rather large. Interorbital about equal to transverse diameter of eye. No enlarged teeth in jaws.

LONGITRUDIS, new genus.

Orthotype, *Platycephalus longispinis* Macleay (Proc. Linn. Soc. N.S. Wales, ix., May 23, 1884, 170. Off Port Jackson) = *Longitrudis longispinis*.

Lower preopercular spine more than twice length of upper. Teeth small and of uniform size. Head less depressed and snout more acute than in *Planiprora* or *Trudis*.

General colour of type-species light brown, with reddish-brown spots, and a row of spaced whitish spots along each side of the dorsal surface.

Family TRIGLIDAE.

CURRUPISCIS, new genus.

Orthotype, *C. volucer*, new species.

Head not particularly rugose. Two spines over anterior margin of orbit. Interorbital space concave. Preorbital produced into three small spines on each side of snout. Bands of teeth on jaws and vomer, none on palatines. Gill-rakers slender, less than half as long as eye.

A row of about 23 spinigerous bucklers along each side of both dorsal fins. First dorsal spine very slightly rugose. Pectoral longer than head. No pungent anal spine.

Scales very small, in more than one hundred transverse rows. Lateral line unarmed. General coloration of body reddish.

This genus is apparently allied to *Chelidonichthys* Kaup (Arch. Naturg., 1873, 87. Logotype, *Trigla hirundo* Linné). I have not seen Kaup's paper, but am guided by Jordan's resume of it (Gen. Fish., iii., 1919, 369-370). *Trigla hirundo* Linné, the genotype, as described and figured by Day (Fish. Gt. Brit. Ireland, i., 1880, 59, pl. xxiv.) differs from the type-species of my new genus in having more rugose and spiny head, with the spines and ridges differently situated, a larger scapular spine, more dorsal bucklers, and quite different coloration.

Two genera of extra-Australian Gurnards may be renamed: *Bellator* Jordan & Evermann, 1895, preoccupied by *Bellatrix* Boie, 1831, a genus of birds, may be called VEXILLITRIGLA and another new genus, TRISCURRI-

CHTHYS, may replace *Merulinus* Jordan & Evermann, 1898, not *Merulina* Ehrenberg, 1834, a genus of coelenterates.

CURRUPISCIS VOLUCER, new species.

This is the New South Wales species identified as *Trigla kumu* by Steindachner (Sitzb. Akad. Wiss. Wien, liii., 1866, 20) and subsequent authors. It has been well described and figured by Ogilby (Ed. Fish. Crust. N.S. Wales, 1893, 109, pl. xxix.), Stead (Ed. Fish. N.S. Wales, 1908, 114, pl. lxxix.) and Roughley (Fish. Austr., 1916, 184, pl. lxiv.). It differs from the Neozelanic *Currupiscis kumu*, originally described as *Trigla kumu* by Lesson (Voy. Coquille, Poiss., 1826, 214, pl. xix. New Zealand) in having more whitish or blue spots and usually a smaller black ocellus on the pectoral fin. The supraorbital rims appear more elevated and spiny and the profile is more even in the Sydney species. *Trigla papilionacea* Cuvier & Valenciennes (Hist. Nat. Poiss., iv., November, 1829, 50. Ex Solander MS. New Zealand) is a synonym of *Currupiscis kumu*.

The holotype of *Currupiscis volucer* is a specimen in the Australian Museum (No. IA.4667) which I purchased at La Prouse, Botany Bay, New South Wales, on 2nd November, 1930.

As *Chelidonichthys kumu*, Jordan & Richardson (Proc. U.S. Nat. Mus., xxxiii., 1908, 656) have separated the Port Jackson *Currupiscis volucer* from the Japanese *C. spinosus* (McClelland).

Family ANTENNARIIDAE.

PHRYNELOX, new genus.

Orthotype, *Lophius striatus* Shaw & Nodder (Nat. Miscell., v., May 1, 1794, pl. clxxv. "Circa litora Australasiae" (Banks) = Botany Bay, New South Wales) = *Phrynelox striatus*.

Teeth on jaws, vomer, palatines, and pharynx. Direction of premaxillary almost vertical. Body elevated, compressed. Skin covered with prominent spines; no wart-like tubercles. Soft dorsal and anal distinct from caudal. Pectorals and ventrals small and rather slender. Three separate dorsal spines; the first free, slender, and with a trifid appendage at its extremity, the second and third much shorter, not higher than soft dorsal, thick, spiny, and each connected to back by membrane; the membrane of the third dorsal spine does not reach its tip. A smooth groove behind second dorsal spine. About eleven dorsal rays. Lateral line distinct.

The type-species has blackish lines or bars irregularly disposed on body, tending to form ocelli on belly, caudal, and end of anal fin.

*Lophius pictus* and *L. marmoratus* Shaw & Nodder, described with *L. striatus*, have been regarded as synonymous with *L. histrio* Linné, but the New South Wales form had better be regarded for the present as *Pterophrynoides histrio* var. *pictus* (Shaw & Nodder); for references see McCulloch (Austr. Mus. Mem., v., 1929, 406). *Lophius cocinsinensis* Shaw & Nodder (Nat. Miscell., xxiii., 1812, pl. 1012) is apparently a synonym of *Pterophrynoides histrio* (Linné).

Whilst on the subject of the species of "*Lophius*" described by Shaw and Nodder from Australia, I invite attention to a remarkable form which has been unwarrantably overlooked by subsequent authors. This is *Lophius monopterygius* Shaw & Nodder (Nat. Miscell., vi., February 1, 1795, pls. ccii. and cciii.), the drawings of which obviously represent the Sydney "Numbfish" which was later called *Hypnos subnigrum* by Duméril (Rev. Mag. Zool. (2), iv., 1852, 279, pl. xii.). As I do not regard *Hypnos* Duméril as preoccupied by *Hypna* Hübner, 1818, a genus of Lepidoptera, I consider the



correct name for our species is *Hypnos monopterygium* (Shaw & Nodder), a member of the family Narcobatidae.

Of the 1064 plates in Shaw & Nodder's work, 162 represent fishes, but the only Australian specimens illustrated appear to be *Chaetodon armatus* (pl. 57), *Squalus ocellatus* (161), *Raja rostrata* (173), *Lophius striatus* (175), *L. pictus* and *L. marmoratus* (176), *L. monopterygius* (202 and 203), *Ostracion meleagris* (253), *O. auritus* (338), *Trachichthys australis* (378), *Squalus tentaculatus* (630) and *S. appendiculatus* (727).

Family ALUTERIDAE.

BLANDOWSKIUS, new genus.

Orthotype, *Blandowskius bucephalus*, new species.

Depth, measured from origin of soft dorsal to that of anal, less than half standard length, and much more than length of head. Less than forty dorsal and anal rays. Ventral spine obsolete.

Named after Wilhelm von Blandowski, a German naturalist about whom little seems to be known. After taking part in the Schleswig-Holstein war, he was in Victoria in the fifties and sixties of last century. He led a small expedition from Melbourne to the Murray River and back in 1857-1858 and wrote a paper, which was later suppressed, on the fishes of the Murray River, which were collected, observed, and drawn by Gerard Krefft, who accompanied him, or by himself. See Austral Avian Record, v., 1927, 101.

BLANDOWSKIUS BUCEPHALUS, new species.

D.ii/36; A.36; P.14; C.12.

(Plate xxvi., fig. 1).

Head (21.5 mm.) 3.5 in length to root of caudal (76). Depth (32) 2.3 in same. Pectoral (6) equal to eye (6), nearly 3 in snout (17). Gill-opening (5) equal to interorbital (5). Dorsal spine (12.5) 1.7 in head. Base of dorsal (26) subequal to that of anal (25.5).

Body deep, compressed, the ventral profile lower than the dorsal. Two gibbosities before the eyes may be abnormal features. A pair of small nostrils on each side of the lower hump. Teeth acutely pointed, the lateral longest. Gill-opening below eye.

Soft dorsal and anal with their margins evenly rounded, the rays highest towards the anterior end. Rays simple, without perforated membranes. Dorsal spine above hinder half of eye, with four rows of barbs. Distance from origin of dorsal spine to that of soft dorsal fin equal to length of head. Pectorals small, rounded; the rays simple, compressed and thickened distally. Ventral spine obsolete; ventral flap bag-like; anus large. Caudal peduncle as long as deep. Caudal fin rounded.

Head and body covered with minute erect spinules forming a dense pile. Lateral line system feebly developed.

Colour, after long preservation in formalin, straw brown, with the dorsal, anal, and ventral fins hyaline. Caudal with three or four fuscous transverse bars and two rows of dark rusty brown spots near base. Head and body ornamented with irregular rows of similar dark rusty-brown spots, disposed as shown in the accompanying figure. Eye bluish.

Described and figured from the unique holotype, a specimen 96 mm. in total length, from off Wilson's Promontory, Victoria. Australian Museum registered number E. 1263.

Genus MONACANTHUS Schinz, 1822.

MONACANTHUS FILICAUDA Günther.

(Plate xxvi., fig. 2).

*Monacanthus filicauda* Günther, Voy. Challenger, Zool., i., 6, 1880, 50, pl. xxiii., fig. D. South of New Guinea; 28 fathoms. *Id.* Fowler, Mem. Bish. Mus., x., 1928, 456.

The larger of two specimens (No. E. 2897) trawled 11-14 miles off Pine Peak, Queensland, in 24-26 fathoms in August, 1910, is here figured. These agree with Günther's description and figure and have the following characters: D.ii/36; A.36; P.13; C.12. Pectoral rays divided; membranes of dorsal and anal fins perforated at bases. Ventral spine movable. Depth a little less than 2 in standard length.

This species ranges from south of New Guinea to the coast of Queensland in about 24 to 28 fathoms. The New South Wales species hitherto identified as *Monacanthus filicauda* may be separated as a distinct subspecies.

MONACANTHUS FILICAUDA NOTONECTIANUS, new subspecies.

*Monacanthus filicauda* Waite, Proc. Linn. Soc. N.S. Wales (2), ix., December, 1894, 224. Maroubra Beach, near Sydney, N.S. Wales. Specimens in Austr. Mus. *Id.* McCulloch, Austr. Zool., ii., 3, 1922, 124, not figure.



D.ii/37; A.37; P.13; C.12.

Depth at origin of dorsal and anal (30) 2.4 in length to root of caudal (73). Eye (8) 2.8, interorbital (6.5) 3.2, gill-opening (5) 4.6 in head (23). Snout (15) less than first dorsal spine (17).

General form elongate, compressed. Profile of snout convex before eye, but slightly excavate anteriorly. Head and body covered with very small, erect, simple, slightly curved spines, with radiating roots. Lateral line indistinct, but apparently following course shown in accompanying figure.

Dorsal spine long, with asperities tending to form barbs anteriorly and a row of spaced hook-like barbs on each side pointing outwards and downwards. Soft dorsal and anal high, rounded, and with the membranes perforated basally. Pectoral rays simple. Ventral spine movable, with pairs of spinules at its tip and pairs of antrorse barbs anteriorly. Ventral flap with spaced spinigerous ridges. Caudal obtusely truncate, with the first and second rays forming a produced point.

Colour, in spirit, yellowish brown, with some dark brown spots on sides and a large dark blotch below anterior portion of soft dorsal fin. Caudal with two oblique rows of black spots on membranes and a few dark marks near roots of rays.

Described and figured from the holotype, a specimen 73 mm. in length without the caudal fin, or nearly four inches in total length. Australian Museum registered number 1A.1815.

*Localities*.—Coogee Beach, near Sydney, N.S. Wales; washed ashore alive, 10th February, 1924, and collected by G. P. Whitley (holotype). Another from the same place found a few days later and a series collected by the late Thomas Whitelegge, at Maroubra, in January to March, 1894, and recorded by Waite. These show no important variation, and suggest that this subspecies is occasionally washed up on New South Wales beaches in summer, after having, perhaps, been brought southwards on the notonectian current.

The new subspecies differs from typical *Monacanthus filicauda* in having a more elongate body covered with smaller asperities. The back is less elevated, the pectoral rays are simple, and there are only two rows of spots on the caudal fin. Australian records of *Monacanthus sulcatus* Holland may perhaps be referable to *M. filicauda*.

In a popular article on this species (Sydney Mail, October 1, 1924, 45), I suggested for it the vernacular name Cottontail Leatherjacket.

Genus PARAMONACANTHUS Bleeker, 1866.

*Paramonacanthus* Bleeker, Neder. Tijdschr. Dierk., iii., 1866, 12. Orthotype, *Monacanthus curtiorhynchus* Bleeker (fide Jordan, Gen. Fish., iii., 1919, 340). *Id.* Bleeker, Atlas Ichth., v., 1869, 99. Not *Paramonacanthus* Steindachner, 1867, preocc. = *Laputa* Whitley, 1930.

Ventral spine movable, not coalesced with pubic bone, and produced beyond ventral flap. Depth much less than half length, excluding caudal, but more than length of head. Dorsal and anal fins elevated anteriorly.

PARAMONACANTHUS OBLONGUS (Temminck & Schlegel).

(Plate xxvii., fig. 1).

*Monacanthus oblongus* Temminck & Schlegel, Faun. Japon., Poiss., 1850, 291, pl. cxxx., fig. 2. Japan. A type in British Museum. *Id.* Günther, Cat. Fish. Brit. Mus., viii., 1870, 241; Japanese record only.

*Monacanthus broekii* Bleeker, Acta Soc. Sci. Indo-Neerl., iii., 1853, Ichth. Japon., 35. Nagasaki, Japan.

*Stephanolepis oblongus* Jordan & Fowler, Proc. U.S. Nat. Mus., xxv., 1902, 264 & 266, fig. 2. Nagasaki, Japan.

Di.1/28; A.27; P.12; C.12.

Depth at origin of anal (49 mm.) or below dorsal spine (50) 2.6, second dorsal ray (85) 1.5, in length to root of caudal (130). Gill-opening (10.5) equal to interorbital (10.5). Eye (10) 4.4, dorsal spine (18) 2.4, pectoral (14.5) 3 in head (44).

General form elongate, compressed. Upper profile and interorbital convex. Snout long; mouth small, with separate teeth forming a beak. Nostrils in slits. Gill-opening subequal to eye, situated below dorsal spine. Ventral flap below interdorsal space, not so long as ventral spine. This spine is broken in my specimen, but was evidently movable and prickly. Head and body covered with large scales with rugose surfaces; ventral flap and spine with more scattered asperities. Lateral line indistinct in places, but following the course shown in the accompanying figure. Caudal peduncle higher than long.

Dorsal spine originating over posterior portion of eye; it has a row of

strong spines along each side and numerous asperities along its anterior surface. Soft dorsal and anal fins much elevated anteriorly; second dorsal ray much produced; membranes of fins perforated at base. Pectorals small, rounded. Caudal obtusely rounded, without produced rays.

General colour, after long preservation, brownish with irregular darker markings on back and sides as shown in figure. A fuscous mark on back at middle of interdorsal space and others above and below caudal peduncle. Fins hyaline excepting caudal, which has an angular blackish bar crossing the rays and becoming darker above and below.

Described and figured from a specimen 130 mm. in standard length or nearly  $6\frac{1}{2}$  inches in total length. It was trawled a few miles off Bustard Head Lighthouse, Queensland, in 11-16 fathoms, on July 8, 1910. Australian Museum registered number E. 1424.

New record for Australia.

This specimen agrees well with Jordan and Fowler's account and figure of *Stephanolepis oblongus* and is evidently conspecific as the only important differences are the more convex snout, extra pectoral ray, produced dorsal ray, and less tapering body of the Queensland specimen. The produced rays of the dorsal and caudal fins and the shape and colours of this species are stated to be variable.

From *Monacanthus curtiorhynchus* Bleeker (Nat. Tijdschr. Ned. Ind., viii., 1855, 430. Amboina), the genotype of *Paramonacanthus*, my specimen differs notably in having deeper body and less pronounced colour-markings. The dorsal spine is shorter than that of *Paramonacanthus garretti* Fowler (Mem. Bish. Mus., x., 1928, 459, fig. 78. Hawaii).

*PARAMONACANTHUS OBLONGUS OTISENSIS*, new subspecies.

(Plate xxvii., fig. 2).

A series of Queensland specimens, of which one (No. E. 1412) is here illustrated, shows a form of this species, apparently not due to sex, which has a deeper body, increased number of fin-rays, and less defined scales. The intestines contain remains of crustacea and algae. The figured specimen differs from the above-described *P. oblongus* in the following particulars.

Di/30; A.32. Depth (49 mm.) 2.16 in length to root of caudal (106). Ventral spine movable, with some prickles at tip and rugose anteriorly. Scales less apparent but body rugose, covered with spines, which may be simple, double, cusped, or with irregular flanges. Lateral line distinct. No produced dorsal ray. First and fifth branched caudal rays produced. General colour dark in tone with a dark margin to ventral flap; dark markings on body and cross-bands on throat more distinct, and bar on caudal lighter than in Bustard Head specimen of *Paramonacanthus oblongus*.

The holotype of this subspecies, on deposit in the Australian Museum, is merely labelled "Queensland," but many other specimens are preserved from off Hervey Bay, Bustard Bay, Fraser Island, and Cowan Cowan, Moreton Bay, southern Queensland; all were trawled by the "Endeavour" in from 9 to 20 fathoms in July and August, 1910.

*SCOBINICHTHYS*, new genus.

Orthotype, *Balistes granulata* White (Journal of a Voyage to new South Wales, ed. 1, 1790, 295, and fig. New South Wales = Botany Bay).

"Captain Cook's Leatherjacket," called *Balistes granulata* in the appendix to White's *Voyage*, has been the subject of an article by Iredale & Whitley (Austr. Mus. Magazine, iii., 1929, 421). This species has an extremely rough integument, quite unlike that of the Hawaiian *Balistes sandwichiensis* Quoy & Gaimard (Voy. Uran. Physic., Zool., 1824, 214), the type of *Cantherhines* Swainson, 1839, and, as it differs also in general propor-



tions, cannot be retained in that genus. *Balistes granulata* may therefore be nominated the type of *Scobinichthys* and known in future as *Scobinichthys granulatus* (White).

Genus BRACHALUTERES Bleeker, 1866.

BRACHALUTERES FIDENS, new species.

D.i/29; A.26; P.11; C.10 branched rays.

Depth, measured from origin of soft dorsal to that of anal (35.5 mm.), 1.3 in length to root of caudal (48); head (16.5) nearly 3 in same. Eye (5) 3.3 in head or 2 in snout (10). Interorbital (7) wider than length of longest pectoral ray (6.5). Base of soft dorsal (20.5) longer than that of anal (18). Depth of caudal peduncle (10) greater than its length (6).

Depth equal to length to base of caudal fin, due to the downward extension of the baglike ventral flap. Dorsal profile more convex than ventral. A concavity in the profile before the eyes. Interorbital roundly convex. Head and body elevated and strongly compressed, covered with prominent, erect spines with hooked tips and small irregular flanges. Gill-opening oblique, situated under posterior half of eye and on a level with the mouth, its length equal to pectoral base. Mouth small, its width less than diameter of eye. Jaws beaklike, the median pairs of teeth longest and flanked on each side by similar but smaller teeth, forming a median and two lateral points in each jaw. Ventral flap roundly convex, without an exterior pubic spine.

Dorsal spine curved, weak, tapering, rugose, originating over posterior margin of orbit and connected to back by broad membrane. Soft dorsal and anal fins gently rounded, with simple rays. Caudal broadly rounded; its upper and lower rays simple and the ten median rays branched.

General colour green, with about six indistinct horizontal dusky stripes on upper half of sides, and many small dark spots on lower half. Fins plain, except caudal, which has numerous dark brown spots, especially towards its base and border.

Described from the holotype, a specimen 2½ inches in total length, from Shellharbour, New South Wales. Austr. Mus. registered number IA. 1822.

This species is common in New South Wales, especially around wharf piles, where it feeds on small crustacea. The ground colour varies from greenish to brownish and the stripes and spots appear to vary in different specimens. This species has been called *Brachaluteres trossulus* by authors, but the New South Wales form has flanges on the dermal spines which are not shown in *Aleuterius trossulus* Richardson (Zool. Voy. Erebus & Terror, Fish., 1846, 68, pl. xl., figs. 5-6, as *Alutarius*. W. Australia), and its colour-markings, though variable, do not agree with those depicted by Richardson.

Family CANTHIGASTERIDAE.

Genus CANTHIGASTER Swainson, 1839.

CANTHIGASTER AXIOLOGUS, new species.

New name for *Canthigaster cinctus* McCulloch (Mem. Qld. Mus., vii., 1922, 245, pl. xiv., fig. 1), which, as McCulloch suggested by his queried synonymy, is distinct from *Tetrodon cinctus* Richardson (Zool. Voy. Samarang, Fish., 1848, 20. Et Parkinson MS. Tahiti) which is described as having small round dots on the upper surface and on the caudal fin, and two oblique black bars on the forepart of the belly. None of these features applies to McCulloch's species. Richardson had earlier introduced *T. cinctus* as a queried synonym of his *Tetrodon solandri* (Zool. Voy. Sulphur., i., Fish., 1845, 125).

The holotype of *Canthigaster axiologus* is the Queensland Museum specimen, from near the Capricorn Group, Queensland, figured by McCulloch.

## ADDENDUM.

The following new generic names are proposed to replace the preoccupied names of some extra-Australian fishes.

- NEGOGALEUS (fam. Galeidae) for *Hemigaleus* Bleeker, 1852, not *Hemigalea* Blainville, 1837, or *Hemigalus* Jourdain, 1837 (Mammalia). Type, *H. microstoma* Blkr.
- PARAPHOTICHTHYS (fam. Gonostomatidae) for *Manducus* Goode & Bean, 1895, not *Manduca* Huebner, circa 1806 (Lepidoptera). Type, *Gonostoma maderense* Johnson; recently figured by Norman, Discov. Rept., ii., 1930, 294.
- RA (fam. Characinidae, subfam. Ichthyoborinae) for *Ichthyoborus* Günther, 1864, often spelt *Ichthyoborus* by authors, not *Ichthyoborus* Kaup, 1842 (Aves). Type, *I. microlepis* Günther.
- BARBELLION (fam. Cyprinidae) for *Barynotus* Günther, 1868, not Germar, 1817 (Coleoptera). Type, *B. lagensis* Günther.
- NAZATEXICO (fam. Cyprinidae) for *Orcella* Jordan & Evermann, 1896, and *Orcula* J. & E., 1900, both preoccupied, vide Palmer, Ind. Gen. Mamm., 1904, and Sherborn, Ind. Anim., 1929. Type, *Notropis orca* Woolman.
- BORODINULA (fam. Nemichthyidae) for *Avocettina* Jordan & Davies, 1892, not *Avocettinus* Bonaparte, 1850 (Aves). Type, *Nemichthys infans* Günther. Named after Mr. N. A. Borodin.
- FUYANGIA (fam. Coryphaenoididae) for *Chalinura* Goode & Bean, 1883, not Dalman, 1826 (Arachnida). Type, *C. simula* Goode & Bean.
- HUMEFORDIA (fam. Lutjanidae) for *Fares* Jordan, Evermann, & Tanaka, 1927, which is preoccupied by *Fares* Guichenot (Dict. pitt. Hist. Nat., iii., 1835, 164; Nouv. Dict. class. Hist. Nat., ed. 2, xii., July, 1845, 345), another genus of fishes allied to, or synonymous with, *Coryphaena* Linné. *Humefordia* is named after Mr. Alexander Hume Ford, of Honolulu, with *Aphareus thompsoni* Fowler as type.
- HOSPILABRUS (fam. Hosiabridae; near Labridae) for *Malapterus* Cuv. & Val., 1839, preoccupied by Jarocki, 1822, an emendation for *Malapterurus* Lacepède, another genus of fishes. Günther emended *Malapterus* Cuv. & Val. to *Malacopterus*, but this name is preoccupied in Coleoptera.
- STOMOGOBIOUS (fam. Gobiidae) for *Orthostomus* Kner, 1868, not *Orthostoma* Ehrenberg, 1831, or *Orthostomum* Grube, 1840, a genus of Coelenterata. Type, *O. amblyopinus* Kner.
- APHYOGOBIOUS (fam. Gobiidae) for *Latrunculus* Günther, 1861, not Gray, 1847 (Mollusca). Type, *Gobius albus* Parnell (non Cloquet and later authors).
- CASSIGOBIOUS (fam. Gobiidae) for *Lophiogobius* Günther, 1873, not *Lophogobius* Gill, 1862 (Pisces). Type, *Lophiogobius ocellicauda* Günther.
- BRYOZOICHTHYS (fam. Pholidae) for *Bryolophus* Jordan & Snyder, 1902, not Ehrenberg, 1839 (Polyzoa). Type, *B. lysimus* Jordan & Snyder.
- PACHYCARICHTHYS (fam. Zoarcidae) for *Pachycara* Zugmayer, 1911, not *Pachycarus* Solier, 1835 (Coleoptera) and not *Pachycare* Gould, 1876 (Aves). Type, *Pachycara obesus* Zugmayer.
- BUFOCERATIAS (fam. Ceratiidae) for *Phrynichthys* Pietschmann, 1927, not Agassiz, 1846, an emendation for *Bufichthys* Swainson = *Synanceja* Bloch & Schneider, another genus of fishes. Type, *P. wedli* Pietschmann.
- LUCUBRAPISCIS (fam. Canthigasteridae), new subgenus of *Canthigaster* Swainson, replaces *Eumycterias* Jenkins, 1901, not *Eumycterus* Schoenherr, 1838 (Coleoptera). Type, *Eumycterias bitaeniatus* Jenkins.

## NOTES ON THE SATIN BOWER-BIRD.

By A. J. MARSHALL, R.A.O.U.

(Plate xxviii.)

During the current spring I have had many opportunities of witnessing the extraordinary habits of the Satin Bower-Bird (*Ptilonorhynchus violaceus*). These birds are still fairly plentiful in the scrubby gullies of Sydney's National Park, where their gaily decorated "play-houses" are not infrequently constructed quite close to the beautiful and popular Lady Carrington's Drive, occasionally as near as ten feet to this busy thoroughfare. The Bower-Birds do not appear greatly to resent the presence of humans near their bowers; in fact, many bowers are built quite close to popular picnicking spots.

Sometimes the one bower is used for several seasons in succession, though in the majority of cases the birds pull the old structure down and re-erect it elsewhere each season. A bower near the Bird Cabin at the Waterfall end of the Park was reconstructed for the third time in four years quite recently. The bower was in use in December, 1929, and the male was invariably in attendance, but from January, 1930, onwards, it was allowed to fall into disrepair—probably after the courting, nesting and incubating periods the birds' interest wanes to a great extent. All through the winter months this bower (and others) remained deserted, and when the locality was visited, late in August, the bower had been removed elsewhere.

A week later we were successful in locating the new bower. Although not yet complete, the front entrance of the bower was adorned with empty bush-snail shells, discarded pupal cases of cicadas, fragments of blue glass, and the usual array of freshly-plucked blue flowers and berries, blue feathers, banksia leaves, and quantities of yellow, straw-like grass. I have yet to see a red object placed at a bower; in fact, on placing fragments of red, blue and amber glass some distance from the bower, I found that the blue was quickly brought to the playground, while the red and amber were left severely alone.

The dry, or partially-dry serrated leaves of the banksia form a popular ornament, and I was interested to note that the Bower-Bird would frequently remove a dry eucalyptus leaf from the bower, yet would often replace it with another dead leaf—a banksia—almost immediately.

It is extremely difficult to obtain a satisfactory picture of the adult male. His lustrous blue-black plumage scintillates in the sunlight to such an extent that the result often suggests a *Gymnorhina* rather than a Bower-Bird!

When first observed, the male was busily engaged in bower-building operations. He would invariably approach from beneath a large pile of logs and debris, and depart in the same direction on each occasion. He could generally be heard approaching through the dry leaves when quite fifteen feet distant, his bill often containing as many as six long slender twigs. After reaching the bower, he would deposit the twigs on the ground at the entrance, select one, carry it inside the bower, and thrust it in among the many others which compose the walls, driving it into the soft earth with a jerky, side-long motion of the neck. Frequently he would withdraw a loose twig from one wall and place it in the opposite side. Often he would snatch up a dry leaf or snail-shell and toss it about playfully.

Although Bower-Birds are usually exceedingly timid, this particular bird was remarkably fearless. He took little exception to a whispered con-

versation, paying no more attention to this than to the vibrant call of the Pied Currawong (*Strepera graculina*) far up on the timbered hillside; merely pausing in his labours, listening intently for an instant, and then continuing with his task. This bird, too, was unusually silent, but he called twice in succession when a gloriously plumaged Crimson Rosella (*Platycercus elegans*) screeched loudly from an adjacent sapling.

On September 13th the bower was complete. It was profusely decorated, and had the walls converging overhead. The male came quite as readily as previously, but on this occasion brought ornaments instead of building material.

It was shortly after 3 p.m. that I witnessed a most peculiar happening. The owner of the bower had been absent about ten minutes when another male approached the bower from the rear. This struck me as being suspicious, and my suspicions were fully justified when the newcomer straightaway commenced to attack the bower viciously. Working rapidly, he demolished the rear entrance in a remarkably short time, and then hopped through the bower, paused for a moment as the camera clicked, and then commenced to level the front portion. It was at this point that I noticed the rightful owner of the bower in a turpentine about fifty yards away. He dropped a blossom held in his bill, and with a long, angry swoop descended on the intruder. The marauding bird evidently heard him coming, for he flew rapidly away through the timber, pursued by the indignant owner of the bower.

It may be assumed with a reasonable degree of certainty that the intruder acted purely out of spite, or jealousy, since no attempt whatever was made to remove any of the material dislodged. From the beginning, his hasty actions indicated that his sole intention was to destroy as much of the bower as he could in as short time as possible. During the next two hours neither bird returned again, but at ten o'clock next morning the bower was quite rebuilt again. On that day, however, the bird was extremely shy, and during four hours did not approach once. It may be that noisy picnickers nearby prevented him from approaching, though it is more likely that he was chary of facing the large movie camera specially obtained by Mr. N. Chaffer for the occasion.

It has frequently been said that the older birds construct the more artistic and substantial bowers, and this contention is supported by a bower observed near Audley, National Park, which, it is said, has been there for at least seven years. This bower is, in many respects, the most remarkable I have yet noted, being easily the most substantially built, and having the greatest and most varied collection of playthings that it has ever been my privilege to examine. It is situated in a sheltered position on a flat near Kangaroo Creek, in close proximity to the Rest House, and amid an area frequented by thousands of picnickers at each week-end.



NOTES ON THE GENUS *STIGMODERA* (FAMILY BUPRESTIDAE).

Together with Descriptions of New Species of and a Retabulation of the Subgenus *Castiarina*.

By H. J. CARTER, B.A., F.E.S.

Plates xxix. & xxx.

(A). NOTES ON THE GENUS *STIGMODERA* (BUPRESTIDAE).

Since my Revision of this group (1) several corrections have been found necessary. Especially helpful has been my correspondence with Mr. K. G. Blair, of the British Museum, who has given much laborious work, both in examining types and in sending me examples for examination with critical notes. The following notes will clear up some perplexities, and will at least, with some certainty, correct my own mistakes.

*Stigmodera* Eschsch., stands as in Revision (p. 92).

Subgenus A.: *Themognatha* Sol.

*duponti* Boisd., is not identical with *Stevensi* Geh. Its brief description indicates *flavocincta* L. & G.; but this is conjecture.

*fusca* Saund., is distinct from *parvicollis* Saund.

The synonymy of the species (No. 10 of my Revision) seems to me as follows:—

- (1) *S. fusca* Saund.; *n. nom.* for *parryi* Hope.  
var. *queenslandica* Obenb.
- (2) ? Subspec. of (1). *pubicollis* Waterh.  
♀ *major* Waterh.  
*lateritia* Saund.
- (3) *parvicollis* Saund.  
♀ *picea* Kerr.

Mr. Blair's notes (2) vary only from the above in placing *queenslandica* Ob. under (2).

Both Kerremans and Blackburn point out that Saunders' substitution of *fusca* for *parryi* Hope is unjustifiable. (*Nascio parryi* Hope was first described as a *Stigmodera*).

An examination of long series from our Museums has cleared my own mind on the three species: *fusca* Saund., *pubicollis* Waterh., and *parvicollis* Saund. The following notes may help the student to distinguish them:—

*S. fusca* Saund. Head bronzy, lightly pubescent. Pronotum red, or reddish brown, without metallic lustre or pubescence; underside coppery to dark bronze, sparsely or not pubescent. Head and pronotum coarsely, irregularly rugose-punctate, the latter with large smooth spaces between punctures.

Pronotum widest at base—here wider than elytra (as in Saunders' figure, also in Obenberger's figure of *queenslandica*), thence arcuately converging to apex, with some crenulations at margin, posterior angles subrectangular, base feebly sinuate, without excisions. Length to breadth as 10:19.

Elytra regularly striate, intervals sharply convex, coarsely and rather closely punctate, giving a more opaque surface than with *parvicollis*. Sterna and sides of abdomen coarsely rugose-punctate, middle of abdomen varying nitid and laevigate.

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- (1). Trans. Roy. Soc. S. Aus., 1916.
  - (2). Ent. Monthly Mag., lxx., 1929, 201-203.

9 examples.	S. Aus. . . . .	6.
	W.A. . . . .	2.
	No label . . . . .	1.

Dimensions: 29-42 x 12-18 mm.

*S. pubicollis* Waterh. only differs from *fusca* in colour and clothing. Head, pronotum and underside coppery to dark bronze, elytra reddish brown to dark brown. Pronotum and elytra with or without narrow red margin. [Of 20 examples 13 are with, 7 without this margin]. Clothing of head, pronotum and underside varies from very long and dense to moderate, of a pale fawn colour beneath, more silvery above.

20 examples.	N.W. Victoria . . . . .	3.
	S. Aus. . . . .	2.
	W. Aus. . . . .	12.
	No label . . . . .	3.

Dimensions: 27-41 x 11-17 mm.

While extreme forms can be readily distinguished from *fusca*, the pubescence seems to be easily abraded. There is thus some reason for considering this as a western subspecies of the South Australian *fusca* Saund.

*S. parvicollis* Saund. Head and pronotum reddish brown to bronzy black, or with varied amounts of each. Elytra castaneous to reddish brown, underside dark bronze or black.

Head generally pubescent, strongly, not uniformly punctate.

Pronotum rugose-punctate, coarsely so at sides, with smooth raised vermiculations, sides crenulate, disc with a more or less smooth middle line (often vague); widest about middle, post angles acute, base sinuate, with marked excisions. Length to breadth as 4:7.

Elytra nitid, deeply striate, intervals rounded, convex, irregularly and sparsely punctate, showing less irregular rugosity at humeral and sublateral region than is usual.

Prosternum transversely wrinkled in front, coarsely punctate behind, metasternum coarsely, closely punctate. Abdomen very nitid and sparsely punctate in middle—often widely laevigate—coarsely and irregularly punctate at sides.

27 examples.	South Aust. . . . .	17.
	West Aust. . . . .	4.
	N.W. Vict. . . . .	3.
	N.S.W. (Broken Hill) . . . . .	1.
	No label . . . . .	2.

Easily distinguished from *fusca* and *pubicollis* by the excised and sinuate base of prothorax, more nitid surface, wider striae and less punctate elytral intervals.

*cyaniventris* Kerr. In my notes, after an examination of type in 1922, considered as synonymous with *variabilis* Don., Mr. Blair has it under *latithorax* Thoms.

*viridicincta* Waterh. The type of this, in Mr. Blair's opinion, in which I concur, is a small variety of *S. donovani* L. & G., in which the green sutural strip is wider than usual. The example, however, which Waterhouse described as *viridicincta* var. seems to me a distinct species and identical with *carpentariae* Blkb. The synonymy thus would appear.

*S. donovani* L. G. = *viridicincta* Waterh. (type).

*S. carpentariae* Blkb. = *viridicincta* Waterh. var.

*jansoni* Saund. was erroneously placed as a synonym of *donovani* L. & G. in my Revision—a mistake corrected in my Check List. It is more elongate than *donovani* and has its underside metallic green. I now think it

probable that *viridicauda* Cart. is a form of *jansonii*. The unique type is in Stockholm Museum.

*quadripilota* Saund. is a good species, distinct from *mittchelli* Hope.

Mr. Blair writes "unique type has thorax dark greenish bronze with sides yellow, but no difference in colour of side parts of dark patch, sides have no marginal thickening (bourrelet) as in *variabilis* or *mittchelli*, a small yellow spot in middle of base. Elytra with apices rounded, no emargination as in *mittchelli*, underside dark bronze, no pale sides to segments, prosternum wide and feebly convex between coxae (furrowed in *mittchelli*), 5th ventral segment very feebly emarginate, 6th without medial longitudinal depression."

Two examples in the Macleay Museum (also in Melbourne Museum) exactly fit this description. The elytral dark spots tend to coalesce into short fasciae.

Since publishing my Revision, in 1916, twelve names have been added, six each by Obenberger and myself. Of Obenberger's species *nickerli* and *strandii* are, I consider, forms of *Castiarina maculiventris*, and cannot, if I am correct, be included under *Themognatha*. The others, *queenslandica*, *desperata*, *mrazi* and *jakovlevi* are considered as synonyms of recorded species. Of my own species *viridicauda*, *praeterita*, *ducalis*, *miranda*, *marginalis* and *particollis*, the first may prove to be a variety of *jansonii* Saund., the distinction of which from *donovani* was at the time not clear to me.

*praeterita* may be considered as a well defined subspecies of *affinis* Saund. without red markings.

*miranda* may, with further material, be found to be a colour variety of *ducalis*. The structural characters are similar.

*particollis*. Mr. Blair suggests the possibility of this being a variety of *caroli* Blkb., a very variable species. Of 5 examples of *caroli* before me, three have the pronotum red, with margins only narrowly bronze, one has the pronotum wholly bronze, the fifth has the pronotum partly bronze as in *particollis*, but the rest of upper surface red (testaceous in *particollis*). In one example only is there a short interrupted fascia and sutural spot black. All have the apices narrowly black or blue-black. The structural characters support Mr. Blair's suggestion.

*wimmerae* Blkb. This also is another var. of *caroli* Blkb., which by right of priority must have precedence. The synonymy running as follows:—

- S. (Themognatha) wimmerae* Blkb. = *capucina* Blkb. (var. 1).
- = *caroli* Blkb.
- = *particollis* Cart. (var. 2).

#### (B). SUBGENUS CASTIARINA.

The following retabulation includes species described since 1916, while making necessary corrections:—

Further study also informs me of the great complexity in variation of certain species, though such variations do not apparently occur in a large—probably the greater—number of species. The variations of pattern may be generalized under two heads.

(1) Loss of certain markings. (2) The spreading of one colour—often metallic green or blue—over a large part or the whole of the elytra. Examples of (1) are var. *triramosa* Thoms. of *simulata* L. & G.; var. *leai* Cart. of *dimidiata* Cart.; var. *semisuturalis* Saund. of *ignota* Saund. For examples of (2) vide my 1916 Revision, p. 81. A rare variation is structural—that of the elytral apices, on which I commented (l.c., p. 82). Lately an examination of *S. impressicollis* MacL. has shown certain N. Queensland examples (the type from the Manning River, N.S. Wales, is clearly bispinose) to be distinctly trispinose; the two interior spines corresponding with the bis-

pinose examples, while the 2nd elytral costa is produced to form a 3rd spine. The examples are otherwise indistinguishable. This form needs distinction, for which I suggest the name *trispiculis* n. var. Again in a series of *cineta* Btkb.,—clearly synonymous with *flaviceps* Cart.—variations occur (1) in pattern, from loss of dark portions, (2) in the absence of frontal yellow spot. (Four specimens from Waneroo and Moore River, W.A., are only distinguishable from others in having the forehead a fiery copper colour). (3) In having trispinose examples. Of eleven examples before me two have trispinose apices, the rest being distinctly bispinose. Of two examples from Tammin, W.A., one has three, the other two spines on each apex. Such instances are rare; the apical structure being one of the most constant and reliable characters for specific distinction, I suggest the varietal name *cupriceps* for (2) and *tridens* for (3).

The predominant use of colour markings in the tabulation is due to the following considerations. (1). The table is intended for use in museums and by collectors who need a ready guide for determinations. The colour characters of a species are so frequently identical as to be, on the whole, the simplest criterion of distinction, though the expert will not take this as final. It is a first aid diagnosis that must, for real accuracy, be supplemented by other character considerations. The weak point of any table is the inter-relation between different species associated with any one selected character. Thus in the following the *bifasciata*, *kirbyi* and *scalaris* groups each contain a few species that might, in certain forms, be transposed. Here I can only give my experience as to the commoner form, and have inter-polated a few notes that may be helpful, where there is frequent variation. An asterisk before a name denotes a species unknown to the author in nature, but is included on its description.

A nearer approach to finality, in doubtful cases of identification, could—and should—be attained by authors practising a free interchange, or loan, of specimens. The British Museum is the depository of the greater number of types in this genus. It would not be difficult for European authors to submit their specimens to that institution for comparison before adding more names to the long list of synonyms. Varietal names only deserve publication in two cases: (1) Special local forms of common occurrence, subspecies; (2) notably distinct forms that possess some taxonomic value or would be likely to be considered as distinct species were intermediate forms unknown.

With regard to (1) the term subspecies is helpful and correct if—and only—when applied to a distinct geographical race, that is more or less constant in character in a region. Its loose application by cabinet entomologists without field experience is misleading. The existence of such forms is one of the clearest indications of the actual process of evolution. The close study of a large insect genus, with many common and widely spread species, like *Castiarina* is one of the most impressive object lessons in genetics. Good examples of subspecies are *C. rufipes* MacL. and *C. malleana* Cart. (the former redescribed by Obenberger as *stigmaticollis*).

While it is possible that hybridization occurs with *Stigmodera*, there is at present no evidence of this. Only experiments under close observation in captivity can educe such evidence. Cases of different species being found "in cop" do not afford evidence of either (1) specific relation, or (2) of fertilization. During the "angophora" season round Sydney I have more than once found the larger species *variabilis*, *macularia* and *suturalis* thus paired. I also have a pair of *Castiarina* taken "in cop" by a very accurate observer, Mr. E. Sutton, of Stanthorpe, Queensland, of which the ♂ is *decemmaculata* Kirby and the ♀ is *punctatosulcata* Saund.



*Castiarina maculiventris* Macl. The sexual coloration here is strongly shown and constant. ♂. The only dark marking on the elytra is the suture, this sometimes widening into a preapical spot; the abdomen wholly yellow. ♀. There are generally two wide fasciae and a large triangular apical or subapical, narrowly produced to apex mark, besides the suture dark blue; the premedial fascia is short, interrupted at suture and variable, the abdomen more or less dark green, with yellow that vary from wide transverse areas to examples in which only a few lateral spots occur. In both sexes the hinder margins of elytra are widely red. I have before me 9 ♂♂ and 9 ♀♀; 2 from Kuranda, the rest from Milmerran, S. Q. As already pointed out, *S. nickerli* Obenb. and *S. strandi* Obenb. are evident synonyms, the former representing the female, the latter the male form; both erroneously described as *Themognatha*.

*S. straminea* Macl. = *cara* Blkb. var. 1 = *placens* Kerr. var. 2.

This presents one of the most remarkable cases of pattern variation in the genus, and one that has been unmistakeably proved by two instances of field observation by Mr. E. Sutton, of Stanthorpe, and by myself. Four examples (clearly *cara* Blkb.) taken at Stanthorpe, Queensland, vary, as follows: In three the pronotum and sternum are "splendide cuprea," as in Blackburn's description; in the other example they are violet coppery. In two the elytra have the two fasciae and apical mark dark green as in description; in a third example the premedial fascia is absent, while in the fourth the only dark marks on the elytra are two spots—one on each side, representing the remnants of the postmedial fascia. In *placens* Kerr. the golden bronze of the prothorax is replaced by "violacé pourpré à reflets cuivreux." Recently I took, in the Mullaley district of N.S.W., 30 examples, which show similar variation; the extreme form (elytra with two spots only, sometimes with apex dark) being much the commonest, no less than 27 out of 30 examples being so marked. This form is identical with the type of *S. straminea* Macl., showing similar sculpture and structure. It is, perhaps, unfortunate that the more distinctly "patterned" form should form the variety, but the claims of priority are undoubted.

*S. bifasciata* Hope (Gray's Zool. Misc., 1831, p. 25) = *bicincta* Boisd. = &c. This name has been overlooked, probably because the species was erroneously described as from Nepaul. [*Chalcopterus cyanopterus* Hope was similarly treated in the same work]. This necessitates a new name for *bifasciata* Saund., for which I propose the name *brevifasciata* n. nom. *S. cupreoflava* Saund., *violacea* Macl. and *equina* Blkb. are distinct species, erroneously placed as synonyms in my former lists. *Violacea* is very close to *cupreoflava* in colour and pattern. A close comparison of Macleay's type with S.A. examples of *cupreoflava* show a narrower, more cylindric form, more convex prothorax, rather dark colour, the violaceous tints prevailing over the coppery, the elytral punctures rather stronger, its pattern difference as in my table infra.

*obliquefasciata* Obenb. seems inseparable from *violacea* by description.

*equina* Blkb. differs more widely in its smaller size and more pronounced apical armature, besides the absence of violet from the pronotum, and stronger pubescence of the underside.

*decepiens* Westw. varies widely in colour from those in which the elytra is largely yellow; to those in which it is largely (or wholly) black. (var. *octocostata* Cart.).

*bimaculata* Saund., *punctiventris* Saund., *guttata* Blkb. and *igneae* Blkb. are here considered as four distinct species, as distinguished in my table, the first two apparently rare in collections.

*octospilota* C. & G. is as variable, as it is widely spread. The subspecies *rufipes* MacL. occurs in North Queensland.

A second subspecies common in W.A. that I have not seen elsewhere has the loss of pattern strongly marked, the dark area of elytra being limited to humeral mark, suture, margins, and a postmedial fascia.

I have variations of *octospilota* from S. Queensland, in which the whole pronotum and the greater part of the underside is dark.

*picta* C. & G., *S. S. malleeana*. Mr. J. E. Dixon has taken a considerable number of species at L. Hattah., N.W. Victoria, that can, I think, only be considered as a subspecies of *picta*, though with some marked and constant colour distinctions. The disc of pronotum and legs are peacock blue, the yellow colour is more predominant on the elytra than usual, the basal pair of yellow spots being elongate and wide, often connected at the base, with lateral yellow marks. I propose the name *malleeana* for this.

*decemmaculata* Kirby, is also subject to great variation, and is very widely distributed. Examples from Stanthorpe (Q.) have a brassy pronotum, with bright green elytral markings.

*crocipennis* C. & G. Hope MS.) = *parallela* Saund. = *nigricollis* Waterh. This correction, long overdue, has been pointed out by Mr. Blair.

*armata* Thoms. I see no reason for distinguishing my *theryi* from this.

*coccinata* Hope, *guttaticollis* Blkb. A rearrangement of these, with synonymy, is due to a comparison with types by Mr. Blair.

*signata* K. Wrongly determined by me for examples from N.W. Victoria. (Now considered as *distinguenda* Saund, var.). Mr. Blair's note on the type is "quite distinct and appears to me to come near *pallidiventris* C. & G."

*rotundata* Saund. = *moribunda* Saund. The latter is a variety having its pattern sub-obsolete. I have seen others like it from Sydney.

The following are new.

STIGMODERA (CASTIARINA) EBURNEA n. sp.

(Plate xxx., fig. 9.)

Oblong; head golden green, pronotum golden bronze, greenish at base, with an eburneous spot at margin of basal third; continued beneath over the greater part of prosternal flanks; scutellum green; elytra pale testaceous, with the following markings metallic, brownish black; a sub-obsolete basal margin, a small longitudinal mark on each lateral margin, slightly before middle, a small diamond shaped spot on suture between these, the apex narrowly and the suture narrowly to a 2nd spot equidistant from the first spot and the apex. The whole abdomen and a considerable area of the metasternum, and the prosternal process pale testaceous, the remaining areas of underside, legs and antennae green, tibiae bluish green.

Head with shallow excision and medial sulcus; closely punctate.

Prothorax widest at middle; apex arcuate, anterior angles acute and little produced; base lightly bisinuate, with a shallow medial and two wide foveate punctures at the subrectangular hind angles; these extending from the triangular basal excisions; sides well rounded, very slightly sinuate behind; disc rather convex, strongly and rather closely punctate, a little rugose towards sides, a smooth medial line on basal half.

Scutellum subcordate, convex, laevigate.

Elytra sides lightly sinuate, rather strongly compressed before middle, apices wide, subtruncate, without a sign of excision, the margins entire; striate-punctate, intervals nearly flat except at sides; those from the 3rd outwards showing each a line of shallow punctures; striae well marked, seriate punctures irregularly spaced. Underside finely punctate, the metallic areas rather more strongly so, prosternum with sparse recumbent hair.

Dimensions: 13 x 5 mm.

Habitat: Swan River.

A single example, ♂, in the British Museum is remarkable for the prevalence of the pale yellow marking on the underside. The colour of this, as also of the elytra, is very like old (not too old) ivory. The pronotal spot is a narrow extension of the prosternal yellow in an oblique backward direction. It is quite distinct from any recorded species, with some suggestions of *luteipennis* C. & G. Holotype in the British Museum.

STIGMODERA (CASTIARINA) PERLONGA n. sp.

(Plate xxx., fig. 8.)

Elongate, sharply attenuate behind; head, pronotum, underside and elytral markings nitid dark blue, appendages violaceous; elytra yellow with narrow basal margins, suture irregularly but widely, post medial fascia, extending to sides and narrowly connected with sutural mark, and a pre-medial oval patch narrowly extended at suture to apex dark blue.

Head deeply channelled between eyes, rather short, little produced in front; finely and closely punctate.

Prothorax convex, widest at middle, apex lightly bisinuate, anterior angles acute and produced, base rather strongly bisinuate, hind angles acute; sides well rounded, sinuate behind; disc with a subsulcate medial line at basal half, terminating in a small fovea; without apparent excisions at base, a wide lateral depression near hind angles; disc rather evenly punctate, the punctures small and round, larger and more distant laterally.

Scutellum subcordate, deeply concave.

Elytra very little wider than prothorax and three times as long; apices narrowly obliquely excised, each apex forming a single fine tooth; margins with a few strong denticles near this point, otherwise entire; striae punctate, the seriate punctures distinct and regular; intervals very lightly convex except near apex and very finely and sparsely punctate except on shoulders. Underside glabrous, prosternum densely, metasternum and abdomen very lightly punctate.

Dimensions: 13 x 4 mm.

Habitat: ? Sydney. (Wilson).

A single example (♀) in the British Museum is labelled Sydney, Wilson, with a 2nd label Saunders Coll., but I have never seen anything like it from the Sydney region. The elytral pattern is somewhat like that of *campestris* Blkb.; the apical structure is like that of *recta* Saund. or *trifasciata* C. & G., though more narrowly excised than the latter. In form of prothorax and general shape it is very close to *gracilior* Cart. from Queensland. Holotype in the British Museum.

STIGMODERA (CASTIARINA) DISCOIDEA n. sp.

(Plate xxix., fig. 2.)

Elongate ovate, rather flat. Head, pronotum, underside and appendages brassy bronze green in ♂, sombre bronze green (in places bluish) in ♀, elytra dark yellow (scarcely orange), in the ♀ with suture, a large patch covering the basal third, not quite extending to sides, a wide postmedial fascia also not quite reaching sides and a triangular subapical patch, sometimes narrowly extended to apex dark green; ♂ with basal margin, suture and variable, or obsolete subapical patch only, dark green.

Head with usual excavation, closely punctate.

Prothorax widest at middle, apex lightly, base moderately bisinuate, with small excisions, sides moderately rounded without sinuation, anterior angles produced and acute, hind angles rectangular; disc closely punctate,



punctures fine in middle, coarser at sides, sparse at base, a smooth medial line shown near base.

Scutellum scutiform, concave.

Elytra very lightly enlarged at shoulder and constricted behind, apices rounded and unarmed, margins entire; striate-punctate, intervals flat, except 1st (scutellary), 3rd and 5th at base, and all convex at the apex; transversely wrinkled and sparsely punctate.

Prosternum finely, the rest of underside even more finely and closely punctate, and very sparsely pubescent.

Dimensions: 15-17 x 6-7 mm.

Habitat: New South Wales, Blue Mountains (G. E. Bryant and the author); Wahroonga and Lindfield (the author).

Nine examples (4 ♂♂, 5 ♀♀) are before me. I have taken many others that have been confused with the common *undulata* Don. Recently Mr. Blair has correctly refused to admit this determination, and a close examination confirms the distinction. The loss of pattern, hitherto considered as a varietal form is associated with all the males, besides the brighter, more brilliant colour of pronotum and underside noted above. The pattern of the female is very similar to that of *ornata* Blkb. or of *grata* Saund.

Besides pattern distinction, the following differences may help to separate it from Donovan's species:—

<i>undulata</i> Don.	<i>discoidea</i> ♀.
Colour, bronzy, often brassy, green.	more sombre, bluish at sides of pronotum.
<i>Prothorax</i> , hind angles acute.	rectangular.
discal punctures larger.	smaller.
<i>Elytral intervals</i> , lightly punctate.	cross wrinkled with a few punctures.

Holotype ♀ and allotype ♂ in Coll. Carter. Paratypes in British Museum and National Museum, Melbourne.

#### STIGMODERA (CASTIARINA) DOMINA n. sp.

(Plate xxix., fig. 4.)

Elongate ovate, convex. Head, pronotum, underside and appendages dark olive green, elytra testaceous with narrow basal margin, narrow post-medial fascia, enlarged at suture, extending to sides and narrowly connected along suture with small triangular apical mark dark green (or greenish black).

Head deeply excavate, rather coarsely punctate; apex and base bisinuate, the former unusually prominent in middle, the latter without distinct excisions; all angles subacute, sides subparallel on basal half, thence arcuately converging to apex without sinuation; disc strongly, rather rugosely at sides, punctate, more finely on medio-apical area, a smooth medial line near base and a few small laevigate areas elsewhere.

Scutellum scutiform, concave, laevigate.

Elytra scarcely enlarged at shoulders or constricted behind; slightly widest behind middle, rather strongly attenuate behind, apices obliquely lunate with strong external tooth; margins entire, striate-punctate, striae punctures large except near suture, intervals convex throughout, strongly so at sides and apex, and bearing a few small punctures.

Prosternum coarsely, metasternum moderately, abdomen finely punctate and sparsely pubescent.

Dimensions: 15 x 6 mm.

Habitat: Queensland.

A single ♂ example in the Melbourne Museum belongs to the *andersoni* group, so far as pattern goes, but is more robust, convex and attenuate



than *andersoni* C. & G., being nearer the form of *trifasciata* C. & G. The narrow fascia and apical mark, combined with the dark green prothorax and underside distinguish it from others of its group. Holotype in the National Museum.

STIGMODERA (CASTIARINA) INTERSTITIALIS n. sp.

(Plate xxix., fig. 1.)

Narrowly ovate; head, antennae, pronotum and underside clear, dark green, subnitid above, very nitid beneath, with fine recumbent pubescence, legs blue; elytra purple (coppery on raised intervals) with the following markings yellow; a straight basal and premedial fascia, connected at sides and interrupted at suture, and a narrow arcuate preapical fascia extending along sides, about its own width, nearly to apex.

Head excavate and channelled, finely punctate.

Prothorax convex, widest near middle, apex arcuate, base rather strongly bisinuate, excisions marked by small foveae; sides evenly rounded, anterior angles obtuse, posterior acute; disc evenly, densely and finely punctate; medial sulcus clearly impressed and terminated behind in a large fovea.

Scutellum transverse, oval and concave.

Elytra rather abruptly widened at shoulders and well constricted behind these; apices subbidentate, with rather wide shallow lunation, limited by two very short teeth; subapical margins finely denticulate; striate-punctate, striae punctures small and close, intervals minutely and varying punctate, the 2nd, 4th and 6th rather strongly costiform; underside with fine shallow punctures.

Dimensions: 11 x 4 mm.

Habitat: Victoria, Walsh Creek.

A single example (♀) in the Melbourne Museum, labelled as above, is a very distinct member of the *bifasciata* Hope group, with raised intervals like those of *coeruleipes* Saund., but even more so. Compared with *coeruleipes* var. *montana* Cart., besides colour differences, the form is narrower, the apices without the strong external tooth, and deep lunation of that species and the preapical yellow fascia extending along sides are all distinctive. Holotype in the National Museum.

STIGMODERA (CASTIARINA) RUBELLA n. sp.

(Plate xxx., fig. 6.)

Oval; head, pronotum, underside and appendages golden green, elytra red, with a straight preapical fascia, extending to sides, and an oval apical mark narrowly connected along suture with fascia blue black; beneath with fine, close pubescence.

Head with shallow excavation, unusually produced in front, clypeus widened and notched in middle; strongly, not closely, punctate.

Prothorax widest at base, moderately convex, apex nearly straight, base strongly bisinuate, without evident excisions, sides arcuately narrowed from base to apex, all angles acute and produced; disc evenly and finely punctate, a medial sulcus subcontinuous throughout, terminated behind by a deep fovea.

Scutellum cordate, concave and punctate.

Elytra moderately enlarged at shoulders, lightly constricted behind, apices with a rather wide semicircular lunation, limited by a strong external tooth, margins entire; striate-punctate, striae punctures generally hidden, intervals mostly flat, convex at apex, and rather strongly punctate and transversely wrinkled; prosternum finely and sparsely, its flanks more coarsely, rest of underside minutely punctate.

Dimensions: 10 x 4 mm.

Habitat: Australia.

A single (♂) example in the Melbourne Museum is distinct in its (*andersoni* C. & G.) group, by the combination of metallic green pronotum and underside, red elytra with the form and pattern of *distincta* Saund. and the apical structure of *kershawi* Cart. Holotype in National Museum.

STIGMODERA (CASTIARINA) RUBICUNDA n. sp.

(Plate xxix., fig. 3.)

Widely oblong ovate. Head, pronotum, scutellum, underside and legs a rich blue, antennae and tarsi green, elytra orange—red towards margins—with the following markings blue or blue-black; suture and basal margins blue; wide postbasal fascia, narrowly connected around scutellum with basal margin, not extending to sides, its lateral border obliquely extending to humeral callus; an irregular postmedial fascia, lozenge shaped at suture, widened at and extending to sides, and a trapezoidal apical mark widely connected with fascia at suture, narrowly covering apex and thence narrowly extending along subapical margins, blue black.

Head excavate, channelled, strongly punctate.

Prothorax widest behind middle, apex lightly, base rather strongly bisinuate, without excisions, but subangulate at their usual region; sides strongly bulging at posterior third, thence obliquely converging to apex and more lightly to base, all angles—especially anterior—acute; disc with three basal foveae, the middle one connected with smooth medial line, the lateral largely occupying depressed area near hind angles; the apical declivity steep; the apical and lateral depression causing a subgibbous aspect to discal area; disc irregularly punctate, the punctures sparse near middle, coarse and subrugose at sides, closer and smaller in intermediate region.

Scutellum subcordate, concave, laevigate.

Elytra slightly widened at shoulders and postmedially, little compressed; apices bidentate with rather wide lunation, a short sutural and larger exterior tooth; subapical margins denticulate; striate-punctate; striae punctures large, intervals mostly flattish, strongly punctate and slightly transversely rugulose.

Prosternum rather coarsely and sparsely, rest of underside more closely and finely punctate, with sparse fine pubescence.

Dimensions: 17 x 7.5 mm.

Habitat: N.W. Australia, Upper Herbert River. (In Coll. of F. E. Wilson).

A single example (♀) of this fine species is nearest *cruenta* C. & G. in its pattern, but is larger, especially wider than it; the pronotum and underside of a beautiful blue. The pronotal structure is near that of *S. pallas* Blkb. from which (as also from *cruenta*) it is clearly separated by the markedly bispinose apices. Holotype in Coll. F. E. Wilson.

STIGMODERA (CASTIARINA) AURANTIACA n. sp.

(Plate xxx., fig. 5.)

Oval; head, pronotum, scutellum, underside and appendages metallic green, glabrous; elytra uniformly orange colour.

Head channelled, with shallow excavation, densely, finely, punctate.

Prothorax widest at base, moderately convex, apex nearly straight, base rather strongly bisinuate, with minute excisions; sides lightly arcuately converging to apex, all angles acute; disc densely punctate, a fine medial sulcus, intermittent and lightly impressed, terminated behind by small fovea.

Elytra enlarged at shoulders, lightly compressed behind them, apices

finely excised and sharply bispinose; striate-punctate, the striae punctures relatively large and close; intervals in general flat, except near apex, minutely and sparsely punctate and transversely wrinkled. Underside densely and unusually strongly punctate throughout.

Dimensions: 8.9 x 3.35 mm.

Habitat: N.W. Victoria; L. Hattah. (J. E. Dixon).

Another of Mr. Dixon's discoveries, of which six examples are before me, 3 of each sex. It can only be confused with *tincticauda* Cart., *immaculata* Cart. and *dispar* Blackb. The first is separated by its raised attenuate intervals and tinted apical area; the second by its sexual coloration and flat, subconic prothorax; the third by its widely ("fortiter") rounded prothorax and testaceous elytra. I have one example, and have seen others of this Queensland species in the National Museum. Holotype ♂ and allotype ♀ in Coll. Carter.

STIGMODERA (CASTIARINA) OBLITA n. sp.

Oblong oval, subdepressed, head and pronotum bright bronze, sometimes greenish at sides, underside green or greenish bronze, antennae and legs blue, elytra yellow with greenish black markings as follows: a post-basal diamond-shaped mark on suture, narrowly connected with base, and in general also narrowly connected with a sinuate vitta covering shoulder and humeral callus, then turning almost at right angles to lateral margin; a straight, rather wide preapical fascia, enlarged at suture, and narrowly connected at suture with an equally wide apical patch.

Head excavate, channelled and closely punctate.

Prothorax convex, widest at middle, apex nearly straight, base bisinuate, without excisions, sides moderately rounded, all angles subacute; disc closely and very finely punctate, a medial line intermittently showing, terminated by a small fovea.

Scutellum subcordate, concave, punctate.

Elytra lightly enlarged at shoulders and compressed behind them, apices bispinose, with rather large lunation, exterior tooth the more prominent, subapical margins minutely, scarcely visibly, denticulate; striate-punctate, striae punctures large and close, intervals flat, except at apex, and impunctate.

Prosternum finely and closely (more strongly on flanks) punctate, rest of underside minutely so, without evident pubescence.

Dimensions: 7.95 x 2.5-3.5 mm.

Habitat: New South Wales, Gordon, Wahroonga, Gosford (the author); Dorriggo (W. Heron), Narrabeen. Queensland: Stanthorpe (Dr. K. Spence Coll.).

Of 10 examples before me, 6 have the postbasal spot connected with the humero-lateral vitta; in 4 this spot is isolated. The species has long been unnamed in my cabinet, though not uncommon in the North Sydney district, as I hesitated to describe what might prove to be a varietal form of one of the *assimilis* Hope group, but the constancy of pattern and colour, flattish form, rather strongly bidentate apices (much as in *kershawi* Cart.) show distinction. It is nearest, in pattern, *minuta* Blkb., in which, however, the suture is dark throughout, the pronotum (and often underside) brilliant coppery and the apices very finely bispinose. Holotype and allotype in Coll. Carter.

STIGMODERA (CASTIARINA) VULGARIS n. sp.

Shortly ovate; head, pronotum, underside and appendages blue, elytra red with the following markings blue: a subcircular spot on suture behind

scutellum, an oblique spot on each side of this behind humeral callus, slightly in advance of the first, a straight postmedial fascia extending to sides, narrowly connected along suture with an oval apical patch.

Head normally excavate, closely, finely punctate.

Prothorax widest behind middle, lightly convex, apex subtruncate, base rather strongly bisinuate, without excisions; sides lightly rounded, sub-sinuate behind; all angles subacute; disc finely, uniformly punctate, a medial sulcus indicated near base and apex, terminated behind in a strong fovea.

Scutellum semicircular, concave.

Elytra strongly widened at shoulders, sinuately narrowed and constricted behind, widest at fascia, extreme apices finely bispinose, with a small lunation, sole apical margins minutely denticulate; striate-punctate, striae punctures rather large and regular, intervals convex throughout, strongly so behind, also the scutellary 1st, 3rd and 5th at base; intervals clearly punctate and slightly transversely wrinkled. Underside finely punctate, most clearly so on prosternum and very sparsely pubescent.

Dimensions: 9-10 x 3.5 mm.

Habitat: Western Australia, Shark Bay and Kalgoorlie.

Four examples before me are apparently undescribed, though belonging to the common *sexplagiata* C. & G. group. The combination of red elytra, blue pronotum and underside and apical mark completely covering apices separates it from *piliventris* Saund. which seems to be its nearest ally.

The pronotum is also much less strongly punctate, its sides widely rounded, and the underside much less pilose.

Holotype in Coll. Cart.

STIGMODERA (CASTIARINA) GARRAWILLAE n. sp.

(Plate xxx., fig. 7.)

Ovate; head, disc of pronotum, elytral markings, underside and legs bright green in ♂ [in the ♀ example the disc of pronotum is blue, its sides also, the ground colour of elytra are orange, and the elytral markings blue-green]; antennae golden, sides of prothorax widely yellow; elytra yellow with the following markings green; base, suture (triangularly widened at base), posthumeral spot, irregular postmedial fascia—not reaching sides—and an oval (subtriangular) preapical mark.

Head excavate and channelled, closely—not densely—punctate.

Prothorax apex arcuate emarginate, anterior angles, from above, acute; base lightly bisinuate, without excisions; posterior angles subrectangular; sides moderately rounded, scarcely sinuate, medial channel indicated near base and apex, punctures subuniform, slightly larger at base and sides.

Elytra lightly obovate, very slightly enlarged at shoulders, moderately compressed behind, apices rounded, margins finely denticulate; striate-punctate, seriate punctures small and indistinct; intervals flat save at apex and the 3rd and 5th at base; clearly punctate on basal third; elsewhere transversely wrinkled. Underside densely and finely punctate and very sparsely pubescent.

Dimensions: 12 x 4.2 mm.

Habitat: New South Wales, Mullaley (the author).

I took two examples (sexes) of this on *leptospermum* flowers in November of this year (1930), which I name after the beautiful homestead of my host, Mr. C. A. Anderson. In pattern it is almost a replica of *C. scalaris* Boisd. from which it is distinguished by the yellow margins, more widely



rounded sides, and the stronger and less dense punctures, of the prothorax; the unarmed apices and denticulate margins of elytra. (Entire in *scalaris*). Holotype in Coll. Cart.

[N.B.: It is a coincidence that my own home at Wahroonga also bears the name *garrawilla*.]

STIGMODERA (CASTIARINA) FLAVOSIGNATA MacI.

var. RUFOSIGNATA new var.

A single example was taken by me at Mullaley, N.S.W., that is strikingly different in colour from the typical Queensland forms. The yellow ground colour and underside is here replaced by blood red, while the dark pattern of the elytra is golden or brassy green.

[N.B.: This species, so far only recorded from Queensland, is very variable; there is sometimes a yellow basal mark to the elytra, connected at sides with the medial yellow band. The legs and abdominal spots in all examples I have seen are blue; not black as in Macleay's description.]

RETABULATION OF THE SUBGENUS CASTIARINA.

Section A.: Elytra carinate-costate. (*Erythroptera* Boisd. Group).

1. Elytra wholly, or chiefly yellow. . . . . 2.  
   Elytra wholly, or chiefly red. . . . . 4.  
   Elytra dark purple, each with 4 discal and a humeral mark yellow,  
     underside and pronotal margins also yellow. . . *costipennis* Saund.
2. Elytra wholly yellow, pronotum purple. . . . . *attenuata* Cart.  
   Elytral apices, or subapical mark dark. . . . . 3.
3. Pronotum testaceous, elytral apex brown. . . . . *testacea* Saund.  
   Pronotum black, elytral apex black. . . . . *nanula* Kerr.
4. Pronotum dark. . . . . 5.  
   Pronotum red with black vittae. . . . . *decipiens* Westw.  
     . . . . . *capucina* Thoms.  
     . . . . . *tricarinata* MacI.  
     . . . . . var. (elytra black) *octocostata* Cart.
5. Pronotal surface normally even. . . . . 6.  
   Pronotal surface notably uneven. . . . . 9.
6. Elytra with subapical mark only dark. . . . . *balteata* Saund.  
   Elytra with suture and apex, or subapical mark dark. . . . . 7.
7. Apex black. . . . . *acuticollis* Cart.  
   Subapical mark black. . . . . 8.
8. 11 mm. long, dark suture not continuous to base. . . *erythroptera* Boisd.  
   6 mm. long, dark suture throughout. . . . . *canaliculata* Blkb.
9. Elytral apices divergent and tridentate. . . . . *nasuta* Saund.  
   Elytral apices not divergent, bidentate (except var. *trispiculis*  
     *infra*) . . . . . 10.
10. Tibiae widened. . . . . *latipes* Cart.  
   Tibiae normal. . . . . 11.
11. Narrowly elongate, suture only dark. . . . . *impressicollis* MacI.  
     . . . . . *costalis* Saund.  
     var. apices tridentate . . . . . *trispiculis* Cart.  
   Wider, elytral intervals in general black. . . . . 12.
12. Sides of prothorax irregular, elytra produced at suture. . . . .  
     . . . . . *spinolae* C. & G.  
     var. sutural intervals only black. . . . . *fossithorax* Obenb.  
   Sides of prothorax evenly arcuate, elytral apices lightly notched. . .  
     . . . . . *praetermissa* Cart.

## Section B.: Elytra without prominent costae.

- (I) Elytra yellow or red, in general without dark markings, except a narrow basal border (1). . . . . (*flava* Saund. group).
13. Abdomen yellow. . . . . 14.  
 Abdomen metallic green or coppery. . . . . 15.
14. Head and prothorax chiefly yellow. . . . . *flava* Saund.  
 . . . . . *flava* Thoms.  
 . . . . . *flavescens* Mast.  
 . . . . . *flavidula* Kerr.  
 . . . . . var. *notulata* Obenb.  
 Head and prothorax metallic green or bronze. . . . . *pallidipennis* Blkb.
15. Elytra unicolorous, intervals subuniform. . . . . 16.  
 Apical third suffused with red, alternate intervals raised. . . . .  
 . . . . . *tincticauda* Cart.
16. Sides of prothorax more or less roundly widened. . . . . 17.  
 Sides of prothorax narrowed from base. . . . . 18.
17. 19 mm. long apices strongly bispinose . . . . . *intacta* Cart.  
 13 mm. long apices finely bispinose, pronotum and underside of ♂  
 golden green, of ♀ coppery. . . . . *auricollis* Thoms.  
 . . . . . *planata* Cart.  
 7-8 mm. long, without sexual coloration. . . . . *dispar* Blkb.  
 . . . . . *semenovi* Obenb.
18. Elytra testaceous, pronotum and underside as in *auricollis*. . . . .  
 . . . . . *immaculata* Cart.  
 Elytra orange, pronotum and underside without sexual coloration. . . . .  
 . . . . . *aurantiaca* Cart.
- (II) Elytra yellow or red, with suture, apex (or preapical mark) or both dark; rarely also with small discal spot. (*rufipennis* Kirby Group).
19. Pronotum black. . . . . 20.  
 Pronotum metallic. . . . . 23.  
 Pronotum bicolorous. . . . . 34.
20. Pronotal sides widely rounded, with large laterobasal fovea. . . . .  
 . . . . . *rufipennis* Kirby.  
 Pronotal sides less widened, without such fovea. . . . . 21.
21. Apical third of elytra dark. . . . . *nigriventris* MacL.  
 Suture and extreme apex only dark. . . . . 22.
22. Elongate and parallel. . . . . *crocipennis* C. & G.  
 . . . . . *parallela* Saund.  
 . . . . . *nigricollis* Waterh.  
 Widely ovate. . . . . *amplipennis* Saund.
23. Apex of elytra only dark. . . . . 24.  
 Suture and apex dark. . . . . 31.
24. Abdomen metallic. . . . . 25.  
 Abdomen yellow or red. . . . . 29.
25. Apices narrowly dark. . . . . 26.  
 Apical third dark (less than 10 mm. long). . . . . *phaeorrhea* Kirby.
26. 20 mm. long. . . . . *rollei* Kerr.  
 . . . . . *hackeri* Cart.  
 . . . . . *caudata* Cart.  
 14 mm. long or less. . . . . 27.

(1). The basal border is almost universally, narrowly dark. Unless specially noted this may be assumed throughout the table.

27. Pronotum and underside metallic green. . . . . *viridiventris* MacI.  
 Pronotum and underside bronze. . . . . 28.  
 28. Pronotum with laterobasal fovea, apices rounded, margins entire. . .  
*luteipennis* C. & G.  
 Pronotum without laterobasal fovea, apices strongly bispinose,  
 margins finely serrulate. . . . . *punctiventris* Saund.  
 29. Apices with long external spine. . . . . *hirundicauda* Cart.  
 Apices otherwise. . . . . 30.  
 30. Head and pronotum golden green. . . . . *cinnamomea* MacI.  
 Head and pronotum purple bronze, elytra with or without discal  
 spot. . . . . *straminea* MacI.  
 . . . . . *addenda* Kerr.  
 . . . . . *johannae* Théry.  
 With 2 fascia and apex dark, vide No. 206. var. 1. . . . . *cara* MacI.  
 var. 2. . . . . *placens* Kerr.  
 31. Abdomen metallic. . . . . 32.  
 Abdomen yellow or red. . . . . 35.  
 32. 18 mm. long, suture widely dark. . . . . *elongata* Saund.  
 Less than 18 mm. long, suture narrowly dark. . . . . 33.  
 33. Sutural mark continuous to apex, pronotum and underside golden  
 green. . . . . *jucunda* Saund.  
 . . . . . *observans* Kerr.  
 Sutural mark terminated by preapical transverse mark. . . . . 34.  
 34. Pronotum bronze, underside blue. . . . . *sub-pura* Blkb.  
 Pronotum and underside blue. . . . . *fossoria* Cart.  
 35. Elytra testaceous, with or without dark discal spot. . . . . *guttata* Blkb.  
 Apical area of elytra red. vide 203 (1). . . . . ♂ *maculiventris* MacI.  
 . . . . . *rubricauda* Saund.  
 . . . . . *strandii* Obenb.  
 36. Pronotum red, medial area black. . . . . *maculicollis* Cart.  
 Pronotum black with wide red margins. . . . . 37.  
 37. Abdomen black. . . . . *marginicervex* Thoms.  
 Abdomen wholly or partly red. . . . . 38.  
 38. Elytral apices rounded. . . . .  *analis* Saund.  
 Elytral apices strongly spinose. . . . . *armata* Thoms.  
 . . . . . *theryi* Cart.
- (III) Elytra yellow or red, with dark spots (*spilota* C. & G. group).  
 39. Pronotum concolorous. . . . . 40.  
 Pronotum bicolorous. . . . . 49.  
 40. Elytra with 3 free (2) spots. . . . . *octomaculata* Saund.  
 Elytra with 7 spots. . . . . 41.  
 Elytra with 6 spots or less. . . . . 44.  
 41. Elytral spots free. . . . . *spilota* C. & G.  
 . . . . . *septemmaculata* Mannerh.  
 Elytra with 6 spots and apical or subapical mark dark. . . . . 42.  
 42. Elytra with 6 spots and apex dark. . . . . *septemguttata* Waterh.  
 var. spots variously coalescing to form fasciae. . . . . *tyrrhena* Blkb.  
 Elytra with 6 spots and preapical mark dark. . . . . 43.  
 43. 9½ mm. long, pronotum and underside dark bronze, elytral intervals  
 flat. . . . . *septemnotata* Cart.  
 . . . . . *septemmaculata* Blkb.

(1). This synonymy is suggested as extremely probable.

(2). Not marginal, or apical.

- 6-7 mm. long, pronotum and underside bright green, some intervals subcostata. . . . . *sexguttata* Macl.  
 var. elytra without markings. . . . . *puella* Saund.  
 . . . . . ? *humoriguttata* Obenb.  
 . . . . . *carteri* Obenb.
44. Elytra with 6 free spots. . . . . *punctatosiata* Saund.  
 Elytra with 5 free spots (all post-medial). . . . . *quinquepunctata* Waterh.  
 Elytra otherwise. . . . . 45.
45. Elytra with 4 spots, also apex and sutural mark dark. . . . .  
 . . . . . \* *scutellaris* Kerr.  
 Elytra with 4 spots and apex dark. . . . . *quadriguttata* Macl.  
 Elytra otherwise. . . . . 46.
46. Elytra with 3 postmedial spots and apex dark. . . . . *triguttata* Macl.  
 . . . . . *subcostata* Kerr.  
 Elytra otherwise. . . . . 47.
47. Elytra with 2 spots and apex dark. . . . . 48.  
 Elytra with 2 free preapical spots. . . . . \* *diana* Obenb.  
 Elytra with large discal spot and apex dark. . . . . *maculipennis* Saund.
48. Pronotum rugose with strong medial sulcus, elytra testaceous. . . . .  
 . . . . . *bimaculata* Saund.  
 Pronotum otherwise, elytra red. . . . . *binotata* Saund.
49. Pronotum yellow or red, with discal markings dark. . . . . 50.  
 Pronotum dark, with wide yellow margins, abdomen sexually coloured. . . . . *septempilota* Cart.  
 Pronotum golden green, with a lateral yellow mark, elytra with 4 spots and apex dark. . . . . *eburnea* Cart.
50. Abdomen dark. . . . . 51.  
 Abdomen red. . . . . 53.
51. Pronotum yellow with black basal spot, elytra with 2 spots and apex black. . . . . *trimaculata* Saund.  
 Pronotum red with dark discal markings, elytra otherwise. . . . . 52.
52. Pronotum with triangular discal mark, elytra with 5 spots and apex green. . . . . *guttaticollis* Blkb.  
 . . . . . *consularis* Kerr.  
 Pronotum with spade-shaped discal mark, elytra with 6 free spots blue. . . . . *sexnotata* Cart.
53. Elytra with base, 7 spots and apex dark. . . . . *mustelamajor* Thoms.  
 . . . . . *gibbosa* Macl.  
 Elytra with base, 6 spots and apex dark. . . . . *coccinata* Hope.  
 (spots form two fasciae in *elegantula*). . . . . *elegantula* White.  
 . . . . . *atronotata* Waterh.  
 Elytra with base, 3 spots and apex dark. . . . . *quadriplagiata* Cart.
- (IV) Elytra dark with yellow or red spots (*producta* Saund. group).  
 54. Elytral spots and preapical fascia pale, the latter red at margins (except *pulchella* Cart). . . . . 55.  
 Elytra with spots only pale, without red markings. . . . . 67.
55. Pronotum medially sulcate. . . . . 56.  
 Pronotum not sulcate. . . . . 57.
56. Pronotum and underside brassy green. . . . . *producta* Saund  
 . . . . . *acutipennis* Thoms.  
 . . . . . ? *sulcicollis* Kerr.  
 Pronotum and underside black. . . . . *venusta* Cart.  
 . . . . . *suavis* Cart.  
 . . . . . *modesta* Obenb.



57. Elytra green. . . . . *virginea* Erichs.  
Elytra blue or blue black. . . . . 58.
58. Elytral markings transverse (subfasciate) 17 mm. long. . . . .  
. . . . . *harrisoni* Cart.  
Elytral markings otherwise 12 mm. long or less. . . . . 59.
59. Elytra with 2 lateral, besides discal spot, and fascia. . . . . 60.  
Elytra without lateral spots. . . . . 63.
60. 12 mm. long, pronotum and underside brassy green. . . . . 61.  
8 mm. long, pronotum black or blue. . . . . 62.
61. Pronotum with large laterobasal fovea, elytral apices finely  
bispinose. . . . . *delta* Thoms.  
. . . . . *deceptor* Kerr.  
Pronotum without such fovea, elytral apices strongly spinose. . . . .  
. . . . . *spectabilis* Kerr.
62. Pronotum black, elytra with red markings. . . . . *gentilis* Kerr.  
Pronotum blue, elytra without red. . . . . *pulchella* Cart.
63. Apices widely excised, bispinose. . . . . 64.  
Apices closely unispinose. . . . . 65.  
(excision very oblique and narrow, sutural spine obsolete).
64. Exterior spine long, pronotum with postero-lateral fovea. . . . .  
. . . . . *insignis* Blkb.  
var. with yellow basal mark. . . . . *caudata* Kerr.  
Apical spines subequal. . . . . *delicatula* Kerr.
65. Basal yellow marks elongate, preapical transverse. . . . . *acuminata* Kerr.  
Basal yellow marks transverse, preapical linear and oblique. . . . .  
. . . . . *obliqua* Kerr.
66. Elytra with 8 pale spots. . . . . 67.  
Elytra with 6 pale spots. . . . . 68.
67. Pronotum bicolorous, disc coppery, sides green, 17 mm. long. . . . .  
. . . . . \* *jacobsoni* Obenb.  
Pronotum concolorous greenish black, 10 mm. long. . . . . *confinis* Kerr.
68. 7 mm. long, elytra black, all spots near base. . . . . *lilliputana* Thoms.  
. . . . . (*neocuris*) *mastersi* MacL.  
. . . . . *ocularis* Kerr.  
var. with an extra spot near apex. . . . . *dawsonensis* Blkb.  
10.5 mm. long, elytra not black, one pair of spots near  
apex. . . . . 69.
69. Elytra coppery, basal mark L-shaped, medial subfasciate. . . . .  
. . . . . *confusa* Waterh.  
Elytra blue, spots more or less round. . . . . *guttifera* Obenb.
- (V) Elytra chiefly dark or metallic. . . . . (except *variopicta* Thoms.)  
. . . . . (*semicincta* C. & G. group).
70. Abdomen dark. . . . . 71.  
Abdomen at least in part yellow or red. . . . . 79.
71. 18 mm. long or more. . . . . 72.  
12 mm. long or less. . . . . 76.
72. Elytra without defined fascia. . . . . 73.  
Elytra with defined fascia. . . . . 74.
73. Elytra black with yellow margins. . . . . *semicincta* C. & G.  
Elytra yellow, in general suture, large basal, preapical and other  
markings dark. . . . . *variopicta* Thoms.  
Very variable, the dark markings tending to obsolescence; included  
here as clearly closely allied to, but distinct from . . . . .  
. . . . . *semicincta* C. & G.
74. Pronotum dark or metallic. . . . . 75.

- Pronotum red, elytra with humeral spot and medial fascia pale. . . . .  
 . . . . . \* *chobauti* Théry.
75. Elytra with a single yellow, medial fascia. . . . . *magnifica* Blkb.  
 Elytra with longitudinal vitta and narrow preapical fascia yellow. . .  
 . . . . . *jubata* Blkb.  
 . . . . . *tasmani* Obenb.
76. Elytra green, with lateral and preapical marks red. . . . . 77.  
 Elytra blue-black, with wide medial fascia yellow. . . . . *obsepta* Kerr.
77. Preapical mark narrowly fasciate, apex widely dark green. . . . .  
 . . . . . *dulcis* Blkb.  
 Probably a Tasmanian subspecies of *thomsoni* Saund. *colorata* Kerr.  
 Preapical mark widely red, apex narrowly light green. . . . . 78.
78. Preapical red mark with 2 green spots. . . . . *ocelligera* C. & G.  
 Preapical red mark without spots. . . . . *kerremansi* Blkb.  
 . . . . . *apicalis* Kerr.
79. Pronotum yellow with dark markings. . . . . *pertyi* C. & G.  
 . . . . . var. *mima* Saund.  
 Pronotum dark with yellow margins. . . . . 80.
80. Elytra green, with basal, lateral and preapical area red. . . . .  
 . . . . . *luteocincta* Saund.  
 Elytra black, with basal third (except shoulders) yellow. . . . .  
 . . . . . *seminigra* Cart.
- (VI) Elytra dark, with pairs of yellow or red marks, sometimes forming  
 interrupted fasciae. . . . . (*decemmaculata* Kirby group).
81. Prothorax concolorous. . . . . 82.  
 Prothorax bicolorous. . . . . 92.
82. Abdomen dark. . . . . 83.  
 Abdomen more or less yellow. . . . . (3) *pictipennis* Saund.  
 . . . . . var. *laetabilis* Kerr.
83. Elytral margins yellow, or with yellow markings. . . . . 84.  
 Elytral margins without yellow markings. . . . . \* *opacipennis* Obenb.
84. Elytral margins yellow throughout. . . . . 85.  
 Elytral margins with 2 or more yellow markings. . . . . 86.
85. Pronotum purple, elytra with 4 pairs of discal spots. . . . .  
 . . . . . *xanthospilosa* Hope.  
 . . . . . *splendida* Gehin.  
 Pronotum brassy green, elytra with 3 pairs of discal spots. . . . .  
 . . . . . *crocicolor* C. & G.  
 . . . . . *consanguinea* Saund.
86. Elytra with 4 pairs of discal and 2 lateral pale marks. . . . . 87.  
 Elytra with 3 pairs of discal and 2 lateral pale marks. . . . . 88.
87. Pale marks yellow, discal marks oval, non-fasciate. . . . . *parallela* White.  
 . . . . . *elongatula* MacI.  
 Pale marks red, 2 posterior pairs of marks fasciate. . . . . *lepida* Cart.  
 (The lateral marks sometimes coalesce, and continuous throughout.)
88. All discal markings more or less round (non-fasciate). . . . . 89.  
 Some discal markings fasciate. . . . . 90.
89. Pronotum blue-black, each elytron with one lateral spot yellow. . . . .  
 . . . . . *octosignata* Cart.

(3). *pictipennis* Saund. in general with 8 discal and a lateral spot yellow, but the 4 basal spots sometimes coalesce as in Saunders' figure. The 2 small spots near apex are sometimes absent, giving rise to the var. *laetabilis* Kerr.

- Pronotum bronze, each elytron with 2 elongate lateral marks. . . . . \* *balthasari* Obenb.  
 (? colour var. of *parva* Saund.)
- Pronotum bright green, each elytron with 3 lateral marks yellow. . . . . *parva* Saund.
90. Elytra with posterior pair of yellow markings fasciate. . . . . 91.  
 Elytra with 2 posterior pairs fasciate. . . . . *laena* Thoms.  
 . . . . . var. *electa* Kerr.  
 (In *laena*, the basal spot connected with humero-lateral, in *electa* these spots separate).
91. Underside pilose, apices separately rounded. . . . . *mansueta* Kerr.  
 Underside glabrous, apices widely bidentate. . . . . *tropica* Cart.
92. Head without yellow spot, underside dark. . . . . 93.  
 Head with yellow spot, underside (at least abdomen) yellow. . . . . 95.
93. Pronotum with green or coppery margins. . . . . 94.  
 Pronotum with yellow or red margins. . . . . 95.
94. Pronotum purplish, margins green, post fascia produced round apical spot. . . . . *versicolor* C. & G.  
 var. postfascia not extending along sides. . . . . *decemguttata* Gory.  
 . . . . . (archaeozodes) *strandi* Obenb.  
 Pronotum with margins coppery ♂, concolorous blue with disc ♀. . . . . *subversicolor* Cart.
95. Elytral apices bidentate, subapical margins serrulate. . . . . *serratipennis* Cart.  
 Elytral apices *tridentate* (except in *cincta* Blkb. Vide *infra*), margins entire. . . . . 96.
96. Form more or less ovate and obese. . . . . 97.  
 Form oblong (subparallel). . . . . 98.
97. Elytral markings red, intervals strongly punctate. . . . . *argillacea* Cart.  
 Elytral markings yellow, intervals moderately punctate. . . . . *octospilota* C. & G.  
 . . . . . *femorata* C. & G.  
 . . . . . *adelaidae* Hope.  
 . . . . . var. *rufipes* MacI.  
 . . . . . *stigmaticollis* Obenb.
98. Elytral apices pale, margins almost wholly red. . . . . 99.  
 Elytral apices dark, margins largely dark. . . . . 100.
99. 13 x 5 mm., elytral intervals, at least on lateral half, convex. . . . . *cincta* Blkb.  
 . . . . . *rubrocincta* Kerr.  
 . . . . . var. 1 *flaviceps* Cart.  
 . . . . . var. 2 *cupriceps* Cart.  
 . . . . . var. 3 *tridens* Cart.  
 10 x 3 mm. (or less), intervals almost wholly flat. *pallidiventris* C. & G.  
 . . . . . var. *yilgarni* Obenb.

(There are endless variations of pattern in these two common species, from examples in which the metallic area forms 3 fasciae, with sutural and humeral vitta, the latter more or less extending to base to those in which merely the suture and a few vague lines or spots are metallic. Moreover in the larger species (*cincta*), that, in a long series, I can only separate from *pallidiventris* by size and more convex intervals, the apical structure, in general (as Kerremans states) sinuate, is sometimes clearly bidentate and sometimes as clearly tridentate (vide *supra*).

100. Discal pale marks in general isolated (not reaching margin nor suture), apical pair non-fasciate. . . . . 101.  
 Apical 4 pale marks, at least, fasciate. . . . . 102.
101. Basal pale marks more or less round. . . . . *decemmaculata* Kirby.  
 . . . . . *inaequalis* Kerr.  
 Basal pale marks elongate, disc of pronotum bronze. . . *picta* C. & G.  
 subspecies, disc of pronotum blue. . . . . *malleeana* Cart.  
 (In the subspecies the basal pair enlarged and often narrowly connected with lateral yellow.)
102. Basal pale marks round. . . . . *elderi* Blkb.  
 . . . . . *rustica* Kerr.  
 All pale marks more or less fasciate. . . . . *diversa* Kerr.  
 (The last 3 names probably stand for variations of the same species.)
- (VII) Elytra yellow or red, with sutural and lateral vittae dark. . . . .  
 . . . . . *vittata* Saund. group.
103. Pronotum concolorous, vittae continuous to apex. . . . *vittata* Saund.  
 Pronotum with red margins, lateral vitta not continuous to apex. .  
 . . . . . *amabilis* C. & G.
- (VIII) Elytra yellow or red, with postmedial fascia, apex or preapical mark dark; or suture also, and sometimes a humeral spot dark. . . . .  
 . . . . . (*andersoni* C. & G. group).
104. Elytral suture not dark. . . . . 105.  
 Elytral suture in part or whole, dark. . . . . 124.
105. Apices wholly dark. . . . . 116.  
 Elytra with preapical mark dark. . . . . *mastersi* Macl.  
 . . . . . *hoblerae* Cart.
106. Prothorax concolorous, basal dark zone of elytra not extending to shoulders. . . . . 107.  
 Prothorax with yellow margins, basal dark zone extending to shoulders, 9 mm. long. . . . . *titania* Cart.
107. 17-21 mm. long. . . . . 108.  
 15 mm. long or less. . . . . 110.
108. Pronotum golden bronze, elytra without red, fascia short. . . . .  
 . . . . . *aurifera* Cart.  
 Pronotum green or blue, elytra with red markings. . . . . 109.
109. Space between fascia and apical mark red. . . . . *alternata* Lumh.  
 Post margins red, fascia and apical mark connected laterally by dark band. . . . . *erubescens* Blkb.  
 var. without postmedial fascia. . . . . *horni* Kerr.  
 . . . . . *unimaculata* Cart.
110. Hind margins of elytra serrulate. . . . . *longicollis* Saund.  
 Hind margins of elytra entire. . . . . 111.
111. Elytra without red markings. . . . . 112.  
 Elytra with red markings. . . . . 118.
112. Apices strongly bispinose. . . . . 113.  
 Apices not strongly bispinose. . . . . 114.
113. Dark markings of elytra, a narrow fascia and squarish apical mark. . .  
 . . . . . *andersoni* C. & G.  
 . . . . . var. *dicax* Obenb.  
 Dark markings of elytra, a scutellary patch, wider fascia, and transverse apical mark. . . . . *verax* Kerr.
114. 15 mm. long or more, pronotum green or blue. . . . . 115.  
 13 mm. long or less, pronotum black, or bronze black. . . . . 116.



115. Pronotum and underside olive green. . . . . *domina* Cart.  
 Pronotum and underside blue. . . . . \* *bicolorella* Obenb.
116. Basal dark markings not extending to shoulder. . . . . 117.  
 Basal dark markings extending to shoulder. . . . . \* *baliola* Kerr.
117. Basal half of elytra yellow, fascia wide. . . . . *nova* Kerr.  
 . . . . . (pars) *inermis* Kerr.  
 Basal two-thirds of elytra yellow, fascia narrow. . . . . *distincta* Saund.  
 . . . . . *sternalis* Blkb.  
 . . . . . *deliciosa* Kerr.  
 . . . . . (pars) *inermis* Kerr.
- [N.B.: Of examples labelled "*inermis* Kerr. type" in the British Museum,  
 one = *nova* Kerr. a second example = *distincta* Saund.]
118. Elytra red. . . . . 119.  
 Space between fascia and apical mark, red. . . . . 120.
119. Form ovate, pronotum golden green, elytra without posthumeral  
 spot. . . . . *rubella* Cart.  
 Form elongate, pronotum blue, elytra with small posthumeral  
 spot. . . . . *gracilior* Cart.  
 . . . . . *gracilis* Cart.
120. Elytra without posthumeral spot, 13-14 mm. long. . . . . 122.  
 Elytra with large posthumeral spot, 10 mm. long. . . . . *festiva* Cart.
121. Apices strongly bispinose, underside blue-black. . . . . *brutella* Thoms.  
 . . . . . *terminalis* Kerr.  
 Apices finely bispinose, underside coppery green. . . . . *graphisura* Thoms.  
 . . . . . *uniformis* Kerr.
122. Elytral apex dark. . . . . 123.  
 Elytra red with preapical mark only. . . . . 132.
123. Abdomen dark, margins entire. . . . . 124.  
 Abdomen yellow, subapical margins serrulate. . . . . 131.
124. Apices of elytra trispinose. . . . . *pulchripes* Blkb.  
 Apices of elytra bispinose. . . . . 125.  
 Apices of elytra unispinose or simply lunate (without  
 distinct tooth). . . . . 129.
125. Elytra yellow. . . . . 126.  
 Elytra red. . . . . 128.
126. Pronotum bronze, sutural mark only extending from  
 base to fascia. . . . . 127.  
 Pronotum black, sutural mark extending from base to  
 apex. . . . . *campestris* Blkb.  
 . . . . . *deleta* Kerr.  
 . . . . . ? *saundersiana* Obenb.
127. Elytral markings blue, fascia reaching margins. . . . . *skusei* Blkb.  
 Elytral markings blue-black, fascia not reaching margins. . . . .  
 . . . . . \* *laudabilis* Kerr.
- [Hitherto treated as synonyms, but the distinctions suggest separation  
*skusei* sometimes with small shoulder spot.]
128. 20 mm. long, apices of elytra widely dark. . . . . *sancta* Cart.  
 10 mm. long, dark subapical mark narrowly produced to apex. . . . .  
 . . . . . *aeneicornis* Saund.
129. 13 mm. long, pronotum and underside dark blue. . . . . *perlonga* Cart.  
 7-9 mm. long, pronotum and underside otherwise. . . . . 130.
130. Pronotum globose, dark basal markings not produced to shoulders. . .  
 . . . . . *flindersi* Cart.  
 Pronotum subcylindric, dark basal markings produced to shoulders. . .  
 . . . . . *aurolimbata* Cart.

131. Elytra with shoulder spot and markings blue, suture dark only near base. . . . . *fulviventris* Macl.  
 . . . . . ? *ochreiventris* Saund.  
 . . . . . *guttigera* Blkb.  
 Elytra without shoulder spot, markings green, suture dark throughout. . . . . *strigata* Macl.
132. Pronotum and underside golden bronze, fascia and suture abbreviated. . . . . *aureola* Cart.  
 Pronotum and underside bright green, fascia only represented by elongate marks. . . . . *sanguinolenta* C. & G.  
 [The last somewhat anomalous, doubtfully included here.]
- (IX) Elytra yellow or red, with basal margin, humeral vitta, suture, post-medial fascia and apex, or preapical mark, dark. . . . .  
 . . . . . (*undulata* Don. group).
133. Humeral vitta, not extending backward to fascia. . . . . 134.  
 Humeral vitta connected with fascia. . . . . 152.
134. Prothorax concolorous. . . . . 135.  
 Prothorax with yellow or red margins. . . . . 150.
135. Abdomen dark. . . . . 136.  
 Abdomen yellow or red. . . . . 146.
136. Elytra yellow. . . . . 137.  
 Elytra red or with red markings. . . . . 145.
137. 16 mm. or more long. . . . . 138.  
 12 mm., or less, long. . . . . 139.
138. Prothorax widest at middle, body and markings green, apices rounded. . . . . *undulata* Don.  
 Prothorax widest at base, body and markings blue, apices bidentate. . . . . *neglecta* Cart.
139. Elytra with apex dark. . . . . 140.  
 Elytra with preapical mark dark. . . . . 142.
140. Oblong, subcylindric, elytral markings peacock green or blue. . . . . 141.  
 Subovate, elytral markings purple. . . . . *flavopurpurea* Cart.
141. More elongate and parallel. . . . . *wilsoni* Saund.  
 . . . . . var. *sigma* Kerr.  
 . . . . . *septentrionis* Obenb.  
 (doubtfully distinct by sculpture). . . . . ? *montigena* Oke.  
 Shorter, more sinuate elytra. . . . . *flavopicta* Boisd.  
 . . . . . *flavopicta* C. & G.  
 . . . . . *flavovaria* Saund.  
 . . . . . *bicolor* C. & G.  
 . . . . . *colorata* Hope.  
 [Elytra largely green in Tasmanian subspecies.]
142. Some elytral intervals subcostate. . . . . *costata* Saund.  
 Elytral intervals uniform (or not conspicuously raised). . . . . 143.
143. Humeral vitta connected with basal band. . . . . *anchoralis* C. & G.  
 . . . . . *agrestis* Kerr.  
 . . . . . *arborifera* Blkb.  
 . . . . . ? *tantilla* Obenb.  
 [The last described with slight colour distinction, base of pronotum much narrower than elytra at shoulders.]  
 Humeral vitta in general isolated. . . . . 144.
144. Humeral vitta elongate, pronotum and underside green. . . . .  
 . . . . . *iospilota* C. & G.

- Humeral vitta short, pronotum and underside bronze. . . \* *crux* Saund.  
 [Unique in Brit. Mus., undetermined in Australian collections and near  
 some ex. of *jekelli* Saund.]
145. Elytra red, markings green, 12 mm. long or more. . . *indistincta* Saund.  
 Apical regions red, markings blue (shoulder mark small), 8-10 mm.  
 long. . . . . *disjecta* Kerr.
146. Elytra yellow. . . . . 147.  
 Elytra red. . . . . 148.
147. Fascia and subapical mark wide, abdomen yellow in both sexes. . . .  
 . . . . . *abdominalis* Saund.  
 . . . . . ? *unica* Kerr.  
 Fascia broken up into spots, subapical mark narrowly continued to  
 apex, abdomen yellow in ♂, bronze in ♀. . . . . *ignea* Blkb.
148. Prothorax bronze, abdomen ♂ yellow, ♀ bronze. . . . . *jekelli* Saund.  
 Prothorax golden green, abdomen yellow in both sexes. . . . . 149.
149. Pronotum finely punctate, elytral markings golden green, 14 mm.  
 long. . . . . *ignota* Saund.  
 var. without vitta or fascia. . . . . *semisuturalis* Saund.  
 Pronotum coarsely punctate, elytral markings darker, 17 mm. long. . .  
 . . . . . *speciosa* Kerr.
150. Elytra yellow, 10-12 mm. long. . . . . 151.  
 Elytra red, 14-15 mm. long. . . . . *cupida* Kerr.  
 . . . . . (spelt *cupida* on labels of types in Br. Mus.)
151. Preapical mark cordate or anchor shaped. . . . . *tricolor* Kirby.  
 . . . . . *curta* Saund.  
 . . . . . *opima* Kerr.  
 Wide preapical mark surrounding 2 yellow spots (vide 260). . . . .  
 . . . . . *victoriensis* Blk. var. *humeralis* Kerr.  
 vitta often reduced to a spot. . . . . *tillyardi* Cart.
152. Pronotum, underside and elytral markings blue. . . . . *desideria* Cart.  
 [In form and colour near *longicollis* Saund.]  
 Pronotum and underside otherwise. . . . . 153.
153. Prothorax golden bronze, underside and elytral markings golden  
 green. . . . . *deuqueti* Cart.  
 Prothorax and elytral markings blackish, underside bronze. . . . .  
 . . . . . \* *clancula* Obenb.
- (X) Elytra yellow or red, with postscutellary patch, postmedial fascia and  
 apex, or subapical mark, dark. . . . . (*bremei* Hope group).
154. Prothorax concolorous. . . . . 155.  
 Prothorax with yellow or red margins. . . . . 162.
155. Postscutellary patch large. . . . . 156.  
 Postscutellary patch small. . . . . 158.
156. Elytra with apex widely dark, pronotum and underside violet  
 coppery. . . . . *ornata* Blkb.  
 Elytra with preapical mark dark. . . . . 157.
157. Body and markings bronzy black. . . . . *bremei* Hope.  
 Body and markings green in ♀ (markings subobsolete in ♂). . . . .  
 . . . . . *discoidea* Cart.
158. Elytra with apex dark, without humeral spot. . . . . 159.  
 Elytra with preapical mark green, with humeral spot, 7-8 mm. long. . .  
 . . . . . *hilaris* Hope.
159. Prothorax blue-black, 13 mm. long. . . . . *cordifer* Kerr.  
 Prothorax coppery green, 9 mm. long. . . . . *doddi* Cart.
160. Elytra with apex dark, apices bidentate. . . . . 161.

- Elytra with preapical mark (sometimes reaching apex)  
 apices rounded. . . . . 162.
161. Postscutellary patch not extending to shoulders, elytral intervals  
 closely punctate. . . . . *biguttata* Macb.  
 . . . . . *terraereginae* Blkb.  
 . . . . . *triangularis* Kerr.  
 Postscutellary patch extending to shoulders, elytral intervals sub-  
 laevigate. . . . . *gibbicollis* Saund.  
 . . . . . var. *fascigera* Kerr.
162. Postscutellary patch not extending to shoulders, markings dark green  
 or blue. . . . . *grata* Saund.  
 Postscutellary patch extending to shoulders, markings bright green. . .  
 . . . . . *subgrata* Blkb.  
 . . . . . *campestris* Kerr.
- [The last possibly a subspecies of *grata*, found in Alpine N.S.W. and Victoria.]  
 (XI) Elytra dark, in general with 2 yellow or red fasciae.  
 [In *militaris* and *flavoviridis* with a longitudinal vitta also.]  
 . . . . . (*bifasciata* Hope group).
163. Elytra without subhumeral vitta. . . . . 164.  
 Subhumeral vitta connected internally with medial  
 fascia. . . . . 178.
164. 15-20 mm. or more long. . . . . 165.  
 Less than 15 mm. long. . . . . 172.
165. Prothorax concolorous. . . . . 166.  
 Prothorax with yellow or red margins. . . . . 170.
166. Elytral apices rounded. . . . . 167.  
 Elytral apices bidentate. . . . . 169.
167. Dark zones of elytra wide, more or less regular. . . . . 168.  
 Dark zones of elytra narrow and irregular. . . . . *pallas* Blkb.
168. Pronotum bronze, underside blue. . . . . *hoffmannseggii* Hope.  
 Pronotum violet, underside green. . . . . *fairmairei* Kerr.
169. Prothorax strongly widened. . . . . *commixta* Cart.  
 Prothorax lightly widened. . . . . *klugi* C. & G.
170. Whole underside red, subapical margins serrulate. *marginicollis* Saund.  
 . . . . . ? \* *bifasciatella* Obenb.  
 Abdomen only partly red, subapical margins entire. . . . . 171.
171. Prothorax strongly widened, apices of elytra strongly bispinose. . .  
 . . . . . *erythromelas* Hope.  
 . . . . . *longula* Blkb.  
 . . . . . ? *cicerini* Obenb.
- Prothorax lightly widened, apices of elytra bidentate. *cyanipes* Saund.
172. Postmedial fascia yellow. . . . . 173.  
 Postmedial fascia largely red. . . . . *bella* Saund.  
 . . . . . *cruentata* C. & G.  
 var. with basal yellow band. . . . . *dixonii* Cart.
173. Elytra black, blue-black or violaceous. . . . . 174.  
 Elytra green. . . . . *dimidiata* Cart.  
 var. without medial fascia. . . . . *leai* Cart.  
 . . . . . *dorsalis* Obenb.  
 var. with humeral yellow spot. . . . . *fasciosa* Obenb.
174. Apices trispinose. . . . . *bifasciata* Hope.  
 . . . . . *bicincta* Boisd.  
 . . . . . *bicingulata* C. & G.  
 . . . . . *dejeani* Gory.  
 . . . . . *trispinosa* Kerr.  
 . . . . . var. *bina* Obenb.



- Apices bispinose. . . . . 175.
175. Alternate elytral intervals subcostiform. . . . . 176.  
Elytral intervals more or less uniform. . . . . *vicina* Saund.
176. Subapical margins entire. . . . . 177.  
Subapical margins denticulate, subapical fascia continued laterally  
towards apex. . . . . *interstitialis* Cart.  
(extra basal yellow mark as in *montana* infra).
177. Elytra blue-black, apices strongly bispinose (13 x 5 mm.) . . . . .  
. . . . . *coeruleipes* Saund.  
var. with extra basal yellow mark. . . . . *montana* Cart.  
Elytra purple, apices finely bidentate (8-9 x 2.5 mm.) . . . . .  
. . . . . *subbifasciata* Saund.
178. Prothorax concolorous green, vitta straight, not extending to base. . .  
. . . . . *flavo-viridis* Cart.  
Prothorax blue with yellow margins, underside yellow, vitta obliquely  
extending beyond basal margins. . . . . *militaris* Cart.
- (XII) Elytra yellow or red, with basal margin, two fasciae and apex, or  
preapical mark, dark. . . . . (*kirbyi* Guér. group).
179. Prothorax concolorous. . . . . 180.  
Prothorax bicolorous. . . . . 217.
180. Apical mark covering apex. . . . . 181.  
Preapical mark not, in general, extending to apex. . . . . 206.  
[Sometimes modified by a sutural extension to apex.]
181. Abdomen metallic, or dark. . . . . 182.  
Abdomen yellow or red (at least in one sex). . . . . 202.
182. 17-20 mm. long, form robust. . . . . 183.  
15 mm. long, or less, form more slender. . . . . 186.
183. Elytra yellow, markings blue-black. . . . . 184.  
Elytra red, or with red areas, markings peacock blue. . . . . 185.
184. Apices simple, margins entire. . . . . *cognata* Kerr.  
Apices bidentate, hind margins serrulate, pronotum and underside  
coppery green. . . . . *cupricollis* Saund.  
var. pronotum and underside more obscure. *alternozona* Thoms.  
. . . . . *julia* Thoms.
185. Elytra red, apices finely bidentate. . . . . *robusta* Saund.  
Elytra orange, margins red, apices strongly bispinose. *rubicunda* Cart.
186. Elytra yellow. . . . . 187.  
Elytra red, or with red margins. . . . . 193.
187. Form convex and parallel. . . . . 188.  
Form depressed and sinuate. . . . . 189.
188. Pronotum blue, 15 mm. long. . . . . *kirbyi* Guér.  
. . . . . var. *adonis* Obenb.  
. . . . . var. *peregrina* Obenb.  
Pronotum bronze green, 12 mm. long. . . . . *affabilis* Kerr.  
. . . . . *simplex* Kerr.
189. Elytral intervals more or less uniform. . . . . 190.  
Some intervals subcostate. . . . . 191.
190. Elongate, apices obliquely excised. . . . . *trifasciata* Saund.  
More widely ovate, apices evenly bidentate. . . . . *colligens* Kerr.
191. Pronotum black, submetallic, alternate intervals of  
elytra subcostate. . . . . 192.  
Pronotum bronze, intervals 3 and 5 slightly raised. . . *imitator* Cart.
192. Yellow zones, especially basal, wide, markings blue-black. . . . .  
. . . . . *rectifasciata* Saund.  
Yellow zones very narrow, markings violaceous. . . . . *vigilans* Kerr.

193. 14-16 mm. long. . . . . 194.  
 12 mm. long or less. . . . . 196.
194. Apices strongly bispinose, apical spine long. . . . . 195.  
 Apices finely bispinose. . . . . *helmsi* Cart.
195. Elongate attenuate, postmedial fascia narrow. . . . . *pisciformis* Cart.  
 Ovate, postmedial fascia wide. . . . . *thomsoni* Saund.
196. Narrowly oblong, elytral intervals uniform. . . . . 197.  
 Wider and sinuate, elytra with sutural intervals sub-costate. . . . . 199.
197. Pronotum and underside peacock blue or green. . . . . 198.  
 Pronotum and underside bronze. . . . . *recta* Saund.
198. Apices finely bispinose, 8-9 mm. long. . . . . *vegeta* Hope.  
 . . . . . *coeruleiventris* Saund.  
 . . . . . *haroldi* Saund.  
 . . . . . *viridiventris* Saund.  
 . . . . . *neologa* Thoms.  
 var. premedial green band continuous to base. . . . . *cruentata* Kirby.  
 Apices truncate, 6 mm. long. . . . . *coerulea* Kerr.  
 . . . . . *coelestis* Kerr.  
 . . . . . *stillata* Blkb.
199. Apices strongly spinose, pale zones red and wide. . . . . *kershawi* Cart.  
 Apices subobsoletely dentate, pale zones red and narrow. . . . . 200.
200. Pronotum metallic black, elytral striae-obscure, 3rd interval strongly convex. . . . . *carinata* MacI.  
 . . . . . *opacula* Obenb.  
 [Possibly a N. Queensland subspecies of the following.]  
 Pronotum bronze green, elytral striae-distinct, 3rd interval lightly convex. . . . . *sexplagiata* C. & G.  
 . . . . . *plagiata* C. & G.  
 . . . . . *crenata* C. & G.  
 . . . . . *hopei* Boh.  
 . . . . . *similata* Boh.  
 . . . . . *krefftii* MacI.  
 . . . . . *variata* Kerr.
- [With many variations, premedial fascia often broken up into spots.]
201. Elytra with red margins. . . . . 202.  
 Elytra without red. . . . . 203.
202. Elytral margins entire, premedial fascia short and interrupted, abdomen in both sexes yellow (in part at least). . . . .  
 . . . . . ♀ *maculiventris* MacI.  
 [for ♂ see 35] . . . . . *nickerli* Obenb.  
 Hind margins serrulate, premedial fascia continuous throughout, abdomen ♂ red, ♀ blue. . . . . *cruenta* C. & G.
203. Hind margins of elytra entire, apices truncate. . . . . 204.  
 Hind margins of elytra serrulate, apices finely bidentate. . . . . 205.
204. Pronotum coppery, abdomen yellow, in both sexes, 15-20 mm. long. . . . .  
 . . . . . *secularis* Thoms.  
 Pronotum bronze, abdomen ♂ yellow, ♀ metallic, 10-12 mm. long. . . . .  
 . . . . . *sexualis* Cart.
205. Prothorax "splendide cuprea," pale zones of elytra wide. . . . .  
 . . . . . *straminea* MacI. var. *cara* Blkb.  
 Prothorax violet coppery. . . . . var. *placens* Kerr.  
 [vide supra 30.]  
 Prothorax metallic bronze, pale zones of elytra narrow. *maculifer* Kerr.

206. Elytra yellow. . . . . 207.  
 Elytra red, or with red areas. . . . . 210.
207. Apices simple (rounded). . . . . *punctatissima* Saund.  
 Apices more or less bispinose. . . . . 208.
208. Dark zones of elytra wide, subapical mark often extended to apex. . .  
 . . . . . *hopei* Saund.  
 Dark zones of elytra narrow, subapical mark lunate, not extended to  
 apex. . . . . 209.
209. Premedial fascia connected with short longitudinal humeral mark. . .  
 . . . . . \* *ravilla* Obenb.  
 Premedial fascia only enlarged laterally. . . . . *crenata* Don.  
 . . . . . *placida* Thoms.  
 [*crenata* Don. has been difficult to determine. The type apparently  
 lost, but Kerreman's suggestion (Gen. Ins.) agrees with  
 Donovan's figure.]
210. Elytra red. . . . . 211.  
 Elytra with margins only red. . . . . 216.
211. Prothorax widest before middle. . . . . *dilatata* Cart.  
 Prothorax widest at or behind middle. . . . . 212.
212. Form oblong and convex. . . . . 213.  
 Form sinuate, wider and more depressed. . . . . 214.
213. Form robust, 13 x 5 mm. . . . . *sagittaria* C. & G.  
 . . . . . *gravis* Har.  
 . . . . . *obscuripennis* Saund.  
 . . . . . *tacita* Kerr.  
 . . . . . ? *gebhardtii* Obenb.  
 Form slender, 9 x 3. . . . . *amphichroa* Boisd.  
 . . . . . *sexspilota* C. & G.  
 . . . . . *sieboldi* C. & G.  
 var. pronotum and underside golden . . . (?) *protensa* Obenb.
214. Apices simple, pronotum and underside golden. . . . . *pulchra* Saund.  
 Apices finely bidentate. . . . . 215.
215. Pronotum blue-black, underside subglabrous. . . . . *felix* Kerr.  
 Pronotum bronzy, underside pubescent. . . . . *carminea* Saund.
216. Oblong and convex, prothorax brassy bronze, 15 x 5 mm. . . . .  
 . . . . . *aeraticollis* Cart.  
 Sinuate, more depressed, prothorax green bronze, 10 x 4 mm. . . .  
 . . . . . *punctatosulcata* Saund.
217. Margins of prothorax, also abdomen, yellow or red. . . . . 218.  
 Margins of prothorax, also abdomen, green. . . . . *cylindracea* Saund.  
 [Closely approaches *amphichroa* in form and pattern, but the con-  
 stant bicoloration of pronotum and obliquely excised apices  
 distinguish it.]
218. Margins of prothorax, also abdomen, yellow, disc coppery, fasciae  
 very narrow. . . . . *brevifasciata* n.n.  
 . . . . . *bifasciata* Saund.  
 Margins of prothorax, also elytra and underside, red. . . . . 219.
219. Prothorax green, apical mark covering apices, 15½ x 6 mm. . . . .  
 . . . . . *castelnaudi* Saund.  
 . . . . . *castelnaudi* Thoms.  
 . . . . . *thomsoniana* Mast.  
 . . . . . *laportei* Kerr.  
 Prothorax bronze, subapical mark produced to apex at suture, 12 x 5  
 mm. . . . . *distinguenda* Saund.

- Red areas replaced by yellow, preapical fascia often broken up into spots,  $11 \times 3\frac{1}{2}$  mm. . . . . subspecies *differens* Cart.  
 [Many examples taken by Mr. J. E. Dixon at Hattah dist. N.W. Vict.]  
 (XIII) Elytra as in preceding, but premedial fascia broken up into 3 spots.  
 (In *haswelli* Cart. both fasciae thus broken up). . . . . *scalaris* group.
220. Prothorax concolorous. . . . . 221.  
 Prothorax disc violet, margins and apex golden. . . . . *insignicollis* Blkb.  
 Prothorax disc green or blue, margins yellow. . . . . *garrawillae* n. sp.
221. Apical mark covering apices. . . . . 222.  
 Preapical mark not extending to apex. . . . . 232.
222. Abdomen metallic or dark. . . . . 223.  
 Abdomen yellow or red. . . . . 231.
223. 21 mm. long. . . . . *blackburni* Cart.  
 15 mm. long or less. . . . . 224.
224. Elytra yellow. . . . . 225.  
 Elytra red. . . . . 228.
225. Apices obliquely excised, finely dentate. . . . . 226.  
 Apices sharply bispinose. . . . . 227.
226. Pronotum black, hind margins serrulate. . . . . *atricollis* Saund.  
 . . . . . *tripartita* Kerr.  
 Pronotum blue. . . . . var. *deserti* Blkb.  
 Pronotum blue, margins entire. . . . . *propinqua* Cart.
227. Form robust, elytral markings green and violet. . . . . *macleayi* Blkb.  
 Form narrow and attenuate, elytral markings black. . . . . *bogania* Cart.
228. Ovate, depressed, underside and markings golden green. . . . .  
 . . . . . *delectabilis* Hope.  
 Narrow, convex, underside and markings blue. . . . . 229.
229. Pronotum bronze, sides widely rounded, widest at middle. . . . .  
 . . . . . *piliventris* Saund.  
 Pronotum blue, sides lightly rounded, widest behind middle. . . . .  
 . . . . . *vulgaris* Cart.
230. Abdomen, also elytra, yellow. . . . . 231.  
 Abdomen, also elytra, red. . . . . 232.
231. Apices subtruncate. . . . . *haswelli* Cart.  
 Apices acuminate. . . . . *rubriventris* Blkb.
232. Elytral markings blue-black, apices strongly spinose. . . . . *alexandri* Cart.  
 Elytral markings bright violet, apices weakly bidentate. . . . .  
 . . . . . *mackayana* Cart.
233. Elytra yellow. . . . . 234.  
 Elytra red, or with red margins. . . . . 237.
234. Elytral intervals uniform. . . . . 235.  
 Alternate intervals subcostate. . . . . *alternecosta* Thoms.  
 . . . . . *alacris* Kerr.  
 . . . . . *libens* Kerr.  
 . . . . . *quadrinotata* Blkb.
235. Pronotum widest at base, suture dark. . . . . 236.  
 Pronotum not widest at base, suture not dark. . . . . *generosa* Kerr.  
 [Very close to *piliventris*, but ground colour paler, preapical mark not reaching apex, underside less pilose.]
236. Pronotum and underside peacock blue or green. . . . . *scalaris* Boisd.  
 . . . . . *cyanicollis* Boisd.  
 . . . . . *crucigera* C. & G.  
 . . . . . *subtrifasciata* C. & G.  
 . . . . . *media* Hope.



- . . . . . *prudens* Kerr.  
 . . . . . *suavis* Kerr.  
 . . . . . *crucioides* Obenb.  
 var. wholly or largely green. . . . . *viridis* C. & G.  
 Pronotum dark copper, underside blue-black or violet. . . . .  
 . . . . . \* *atrocoerulea* Kerr.  
 237. Robust convex, hind margins finely serrulate. . . . . *convexa* Cart.  
 Narrower, hind margins entire. . . . . 238.  
 238. Prothorax bronze, margins of elytra only red, 11 x 4 mm. . . . .  
 . . . . . *rubrocincta* Gehm.  
 Prothorax bright green, elytra red, 9 x 3 mm. . . . . *filiformis* Blkb.  
 (XIV) Elytra as in *kirbyi* group, but premedial fascia bifurcate laterally,  
 leaving a yellow spot at margin, sometimes continuous with  
 basal zone. . . . . (*australasiae* C. & G. group).  
 239. Prothorax concolorous. . . . . 240.  
 Prothorax bicolorous. . . . . 256.  
 240. Apical mark extending to, or over, apex. . . . . 241.  
 Preapical mark not extending to apex. . . . . 254.  
 241. 20 mm. long or more. . . . . *insularis* Blkb.  
 12-16 mm. long. . . . . 242.  
 11 mm. long or less. . . . . 252.  
 242. Anterior fork of fascia extending to shoulder, basal and  
 marginal spots isolated. . . . . 243.  
 Anterior fork not extending to shoulder, yellow basal  
 zone continuous to margin. . . . . 250.  
 243. Elytral markings cyaneous. . . . . 244.  
 Elytral markings coppery violet. . . . . 247.  
 244. Apical mark bearing two small yellow spots. . . . . *apicenotata* Cart.  
 Apical mark without yellow spots. . . . . 245.  
 245. Elytral apices truncate, basal dark border wide, underside coppery. . .  
 . . . . . *rostralis* Cart.  
 Elytral apices bispinose, basal dark border narrow,  
 underside otherwise. . . . . 246.  
 246. Pronotum black, underside blue, apices strongly bispinose. . . . .  
 . . . . . *australasiae* C. & G.  
 Pronotum bronze, underside greenish, apices finely spinose. . . . .  
 . . . . . (a) *assimilis* Hope.  
 . . . . . (b) *puerilis* Kerr.  
 . . . . . *timida* Kerr.  
 [I have not been able to distinguish (a) from (b) but am unwilling to  
 state their synonymy.]  
 247. 15 mm. long, pronotum violet coppery, underside lightly  
 pubescent. . . . . 248.  
 9.5 mm. long, pronotum brownish coppery, underside strongly  
 pubescent. . . . . *equina* Blkb.  
 248. Narrower, prothorax convex, hind yellow zone not produced backward  
 at margin. . . . . *violacea* MacL.  
 . . . . . *obliquefasciata* Obenb.  
 Wider, prothorax more explanate, hind yellow zone produced back-  
 ward at margin. . . . . *cupreoflava* Saund.  
 249. Elytral markings black, or blue-black. . . . . 250.  
 Elytral markings coppery. . . . . *cupricauda* Saund.  
 250. Elongate oblong, apices obliquely excised. . . . . *browni* Cart.  
 Ovate oblong, apices otherwise. . . . . 251.

251. Postmedial fascia broken into two spots, apices strongly bispinose. . . . . *duaringae* Cart.  
Fasciae unbroken, apices finely dentate. . . . . *inconspicua* Saund.
252. 9-11 mm. long, basal yellow, in general, connected with . . . . . 253.  
marginal spot. . . . . 254.  
Basal yellow, not so connected. . . . . 254.
253. Pronotum bronze, form ovate. . . . . *acuticeps* Saund.  
. . . . . *odewahni* Obenb.  
Pronotum blue or green, form narrow, oblong. . . . . *obscura* Saund.
254. 7-10 mm. long, basal yellow connected, or not, with medial yellow  
zone. . . . . *oblita* n.sp.  
6 mm. long, basal yellow spot isolated. . . . . *minuta* Blkb.
255. Apices trispinose. . . . . *burchelli* C. & G.  
. . . . . *hostilis* Blkb.  
Apices otherwise. . . . . 256.
256. Basal yellow mark isolated. . . . . \* *yorkensis* Obenb.  
Basal yellow mark continuous to margin. . . . . *simulata* C. & G.  
. . . . . *helenae* Hope.  
. . . . . *lanuginosa* Hope.  
. . . . . *perplexa* Hope.  
. . . . . *phryne* Thoms.  
. . . . . *lais* Thoms.  
. . . . . *triramosa* Thoms.  
. . . . . *distinguenda* Thoms.  
. . . . . *fraterna* Kerr.
- [A very variable species with wide distribution from East to West.  
*lanuginosa* Hope is a common form with red margins, commonly  
confused with *burchelli* C. & G. *phryne* Thoms. is a smaller  
testaceous form from W.A. (Geraldton) with narrow fasciae and  
markings.]
257. Prothorax red with black discal mark. . . . . *flavosignata* MacI.  
. . . . . *circumflexa* Obenb.  
. . . . . var. *rufosignata* Cart.  
Prothorax bronze, margins golden coppery. . . . . *cyaista* Rainb.  
Prothorax with yellow or red margins. . . . . 258.
258. Underside dark. . . . . 259.  
Underside with yellow areas. . . . . 262.
259. Margins of prothorax and elytra, also apex, red. . . . . *rufolimbata* Cart.  
Margins of prothorax and elytra yellow, apex dark. . . . . 260.
260. Margins of elytra entire, lateral spot connected with basal and medial  
yellow. . . . . *audax* Saund.  
Post margins serrulate, lateral spot isolated. . . . . 261.
261. Underside strongly pubescent, elytral apical dark area without spots.  
. . . . . *clarki* Cart.  
Underside scarcely pubescent, apical dark area with 2 yellow spots. . .  
. . . . . *victoriensts* Blkb.  
. . . . . *sensitiva* Kerr.  
. . . . . var. *humeralis* Kerr.  
. . . . . (vide supra 151).
262. Apices bidentate. . . . . *eremita* Blkb.  
Apices trispinose. . . . . *signata* Kerr.
- (XV) Elytra yellow with 3 fasciae and the apex dark. . . . .  
. . . . . *rotundata* Saund. group.
263. Oblong, elytral intervals uniform. . . . . 264.

- Shortly obovate, some intervals subcostate, pronotum and elytral markings dark green. . . . . *rotundata* Saund.  
 var. elytral markings subobsolete. . . . . *moribunda* Saund.  
 264. Pronotum coppery, elytral markings bronze, 11 x 3 mm. . . . .  
 . . . . . *quadrifasciata* Saund.  
 Pronotum bright green, elytral markings violet, 7 x 2.5 mm. . . . .  
 . . . . . *ariel* Cart.

*Hypostigmodera variegata* Blkb. [The second example known is a ♂ taken by University Zool. Exp. to Barrington Tops in 1925; now in Macleay Mus.]. This seems to deserve generic distinction, though merged with *Castiarina* by Kerremans. Its pattern suggests *bella* Saund., but there is no red area on the elytra; the apices have two equal teeth.

## EXPLANATION OF PLATES.

## Plate xxix.

- Figure 1. *Castiarina interstitialis* Cart.  
 " 2. " *discoidea* Cart.  
 " 3. " *rubicunda* Cart.  
 " 4. " *domina* Cart.

## Plate xxx.

- Figure 5. *Castiarina aurantiaca* Cart.  
 " 6. " *rubella* Cart.  
 " 7. " *garrawillae* Cart.  
 " 8. " *perlonga* Cart.  
 " 9. " *eburnea* Cart.

## REVIEW.

A Check-list of the Fishes recorded from Australia, by (the late) Allan R. McCulloch, in the *Australian Museum Memoir*, v., pt. 1, pp. 1-144, June 29, 1929; pt. ii., pp. 145-329, September 10, 1929; pt. iii., pp. 329-436, November 28, 1929; pt. iv., 1-x; 437-534, May 26, 1930. Introduction by C. Anderson, Director.

This work, issued by the Trustees of the Australian Museum, is one which should greatly facilitate the study of Ichthyology in Australia.

Prior to his lamented death at Honolulu, the late Allan R. McCulloch had compiled a huge card index of the fishes of the world, comprising some 100,000 entries, and in which he paid especial attention to those species recorded from Australasian and Pacific regions. From this he made a MS. list of fishes recorded from Australian waters. Dr. Anderson has pointed out in his introduction: "It was his earnest desire that, in the event of his death, this list should be published in his name, and it is in fulfilment of this wish that the present Memoir has been issued."

To McCulloch's successor in office, his former assistant, Mr. Gilbert P. Whitley, has fallen the herculean task of the compilation of this Check-list from the card index slips. He has, moreover, unselfishly added to his labours by supplying references, and distribution of the species, instead of adhering to the original scheme of issuing a mere list of names. He is also the author of all the information concerning genotypes, the details of exact dates of publication and the type localities; these greatly enhance the value of McCulloch's Check-list, making it a valuable work of reference for all time. The work reflects in the highest degree upon Whitley's ability as a taxonomic worker, and adds fresh lustre to McCulloch's name.

The work has been produced in a highly creditable manner by The Australasian Medical Publishing Company, Limited, The Glebe, Sydney.

## SOME ABORIGINAL ANIMAL NAMES.

By JOHN MACPHERSON, M.A., M.B., Ch.M., B.Sc., Sydney.

During the years 1899-1901 I resided in Glen Innes, and, in the course of my travels in that and neighbouring areas, I came into close contact with the remnants of the aboriginal tribes from whom I obtained extensive vocabularies. As I am unaware of these vocabularies having ever been published, and, as any opportunity of now obtaining them has probably quite gone, I have appended here the animal names in use by some of the tribes. The En-nee/-win tribe inhabited the neighbourhood of Oban, Kooka-bookra and Ward's Mistake. The Ngar/-rabul tribe extended from Glen Innes to Bolivia and Wellingrove. The Yoo-kum/bul tribe ranged from Inverell to Bukulla, and almost to Bundarra and Bingara. The Bee-gum/bul (or Pikumbul) tribe extended along the Dumaresq and MacIntyre Rivers to the Weir River in Queensland. The words of the Pikumbul dialect, used for comparison, have been taken from the Rev. William Ridley's "Kamilaroi and other Australian Languages," Second Edition, 1875. As regards pronunciation: *a* is always short as in cat. Broad *a* is indicated by *ah*. *E* as in get. *Ee* as in seem. Terminal *i* as *y* in happy. Otherwise *i* as in him. *O* as in hot. *Oo* as in moon. The sequence *one* as in bone. *U* as in sun. *Ai* as *i* in while. *Ao* as *ow* in how. *Oi* as in poise. *Ew* as in new. *G* as in go, not in gentle (where *J* would be used). *Y* as in yard. *Ng* (often at the beginning of a word), as in sing. It is impossible sometimes to express aboriginal enunciation in English letters. I have exercised the greatest care possible in thus translating the words.

My En-nee/-win vocabulary is only small:—

Murray River Cod (*Oligorus macquariensis*—C. & V.)—Orro/tah.

Eel—N'yar/rah.

Tiger Snake (*Notechis scutatus*—Peters)—Erkull/ah.

Black Snake (*Pseudechis porphyriacus*—Shaw)—Ell-een/ya.

Carpet Snake (*Python spilotes* var. *variegata*—Gray)—Apor/tah.

New Holland Honey-eater (*Meliornis novæ-hollandiæ*—Lath.)—mutton/-mutton/ (meaning small bird in the scrubs).

Dingo (*Canis dingo*—Blumenbach)—Yee/kan.

The aboriginal name for Kookabookra Creek in this area was Kook-ar/rah-booka, meaning "porcupine cooking all the time"—that is the Spiny Ant-eater (*Tachyglossus aculeatus*—Shaw).

The Ngarrabul and Yookumbul vocabularies are more extensive:—

Animal.	Ngarrabul.	Yookumbul.	Pikumbul (Ridley).
Frog.	_____	Durr/agi.	Durra.
Flies.	_____	Boo/loo.	Kulungan.
Mosquito.	_____	Gin/nin.	Buri.
Bee, large (? <i>Apis mellifica</i> —Linn.—introduced).	Boo.	_____	
Bee, small (? <i>Trigona car- bonaria</i> —Smith).	Kao or Kob/bai.	_____	
Honey.	Ngar/roo.	_____	
Fish.	_____	Koo/er-rool.	
Murray Cod ( <i>Oligorus mac- quariensis</i> —C. & V.).	_____	Mun/dah.	
Jewfish or Catfish ( <i>Tan- d a n u s t a n d a n u s</i> — Mitch.).	_____	Wag/gar-bal.	



<i>Animal.</i>	<i>Ngarrabul.</i>	<i>Yookumbul.</i>	<i>Pikumbul</i> ( <i>Ridley</i> ).
Fresh-water Bream.	—	Goo/pir.	
Black Snake ( <i>Pseudechis porphyriacus</i> —Shaw).	Kull-een/ya.	Gull-een/ya.	
Birds.	Goon/doo.	—	
Emu ( <i>Dromaius novæ-hollandiæ</i> —Lath.).	Ngoo/run.	Ngoo/run.	Ngurun.
"Plain Turkey" or Bustard ( <i>Eupodotis australis</i> —"Gray").	Goom-bill-goo.	—	
Native Companion ( <i>Magallornis rubicundus</i> —Perry).		Goo/yirr.	
Blue Heron or "Crane" ( <i>Notophoxyx novæ-hollandiæ</i> —Latham).	Durkoon-durkoon.		
Black Swan ( <i>Chenopsis atrata</i> —Latham).		Boor-boor.	Bibu.
Wedge-tailed eagle ( <i>Uroaëtus audax</i> —Lath.).		Mull/ien.	Dug (an eagle).
Nankeen Kestrel or "Sparrow Hawk" ( <i>Falco cenchroides</i> —Vig. and Horsf.).	Door-goo.	Karr/a-been.	Kagun (a hawk).
Cuckoo (? Boobook Owl— <i>Ninox boobook</i> —Lath.).		Toor/goo.	Ngugu.
White Cockatoo ( <i>Kakatoe galerita</i> —Lath.).	Gahr/abul.	Gahr/abul.	Giabun.
Crimson-winged Parrot ( <i>Aprosmictus erythrop-terus</i> —Gmelin).	Wok/ul-boo-too.		
Crimson Rosella or "Lowrie" ( <i>Platycercus elegans</i> —Gmelin).	Gum/mera-bah. (meaning "like blood").		
Rosella ( <i>Platycercus eximius</i> —Shaw).	Bill'an.		
Laughing Jackass or Kookaburra ( <i>Dacelo gigas</i> —Boddaert; <i>Dacelo novoguineæ</i> —Hermann).	Gah/-goon. (from its call).	Kah/-goon.	Kaguran.
Soldier Bird or "Micky" ( <i>Myzantha melanocephala</i> —Lath.).	Bree-pree (from its call).		
Butcher Bird ( <i>Cracticus torquatus</i> —Lath.).	Quarro-too (from its call).		
Black-backed Magpie ( <i>Gymnorhina tibicen</i> —Lath.).	Gullo-mai.		
Bandicoot, large (Gen. et sp. ?).	Bindoo.		
Bandicoot, little black (Gen. et sp. ?).	Hoon-noo-i.		
Bandicoot, spotted (Gen. et sp. ?).	Burr-gah.		

<i>Animal.</i>	<i>Ngarrabul.</i>	<i>Yookumbul.</i>	<i>Pikumbul</i> ( <i>Ridley</i> ).
Grey or long-eared opossum ( <i>Trichosurus vulpecula</i> —Kerr).	Goop-pi.	Koo-bi.	Kubi.
"Native Bear" ( <i>Phascogale cinereus</i> —Goldfuss).	Boor-bee.		
Dingo or Warrigal ( <i>Canis dingo</i> —Blumenb.).	Wongi.		
Dog ( <i>Canis familiaris</i> ).		Mirri.	Mirri.
Horse ( <i>Equus caballus</i> ).	Yarah/-man.		

Of aboriginal place-names, Bundar/ra signified "Old Man Kangaroo" (*Macropus giganteus*—Zimm.). Wellington Vale was called Gahr/rabul-bone, meaning "Plenty of White Cockatoos." Emmaville or Vegetable Creek was Mur/ran, meaning "Plenty of Leeches." Clairvaux was Bungo-bit/tah, meaning "Plenty of Flying Squirrels" (*Petaurus sciuroides*—Shaw).

The Bundel or Bun/della tribe occupied part of the upper Clarence River area. In their district was Gordon Brook, called Bull/ngan-bah. This applied actually to the hills on the flat through which the stream flows. Before the advent of the white settlers the aborigines were wont to kill many kangaroos there. One large kangaroo was killed and his leg-bone (the fibula) was sharpened and used by the natives as a needle (bul/lul) with which to sew opossum cloaks. According to Mr. C. W. Bundock, Yulgilbar, in the same area, signified "the place (bar) of the Platypus (yul-gil)," although my aboriginal informant, who was born there, stated that it meant "something caught in a tree."

On comparing the Ngarrabul and Yookumbul dialects with those of other aboriginal tribes marked similarities may be observed. Ridley's book gives vocabularies of the tribe inhabiting George's River and south to Appin and Cowpasture; the Kamilaroi tribe (extending from the Upper Hunter River to the Liverpool Plains and further north-west); the Wailwun tribe (on the Barwon River below the junction of the Namoi); the Turrubul tribe (on the Brisbane River, Queensland), and the Dippil tribe of Queensland (north of Moreton Bay, towards Wide Bay and the Burnett River). In the Kamilaroi tongue Flies were "Burulu." "Kao" was an insect in Kamilaroi, and, according to Sir Thomas Mitchell, "Cow" was a small fly on the Karaula (MacIntyre River). In Dippil honey from the small native bee was "Kobbai." E. S. Sorrenson states that two species of bees on the Richmond River were called by the blacks "Cobbi" and "Booyen." My words for Black Snake have a superficial resemblance to the Latin *anguis*, but this doubtless is a mere coincidence. When we turn to the terms for the emu we find "Nguri" in Wailwun and "Ngurun" in Dippil. Lieutenant Breton (1833) gives "Norong" as the name amongst the Bathurst natives. These names may be in imitation of the bird's booming call.\* Mullion was an eagle, both in Kamilaroi and Wailwun.

When we turn to cuckoo it seems to me obvious that the Boobook Owl is intended, the term being an excellent imitation of its call. This would be one of the most typical onomatopœic names which occur so plentifully in Australian languages. In Kamilaroi the "Cuckoo" is "Murgu." "Boobook," of course, is the popularly accepted aboriginal designation for the Cuckoo Owl. The White Cockatoo was "Ké-a-ra-pai" on the Lower Hunter

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\* In Kamilaroi the Emu was "Dhina-wan" (foot-strong).

River and Lake Macquarie (Threlkeld, 1834) and "Karabi" in the George's River, Appin dialect. The Laughing Jackass was "Kukuburra," and also various other designations in Kamilaroi. This is the origin of the popularly accepted term "Kookaburra." Many and varied were the names in the native dialects for this bird. All or most of them were onomatopœic in imitation of the various notes of its call. Thus we have "Goburra" of my school days; "Gogera" or "Gogobera" (Dr. George Bennett); "Kahkowan" (Turrubul); "Kaggu" (Dippil); "Kogunda" (Appin to George's River) and many others.

Turning to the Mammals we find the Opossum is "Kubbi" in Turrubul. A dog was "Mirri" in Wailwun and Turrubul, and the Dingo was "Murren" in Kamilaroi. In Brough Smyth's monumental work we find the names for Dingo as follow:—"Myeye" (Karaula River); "Mirree" (Wellington Valley); "Merry" (Regents Lake, Lachlan River); "Merrigang" or "Warrigal" (Wollondilly River) and "Méhee" (Moreton Bay). The word "Waragul" or "Wuragul" signified wild or savage in the dialect of the Yarra and Western Port natives of Victoria.

Breton gives "Miree" for the Native Dog at Bathurst. Turning to the somewhat erratic vocabulary of Threlkeld we find:—"Tingko," a bitch, evidently the origin of the popular "Dingo." But we find that a *tame* dog was "Wa-ri-kul" and the species dog in general was "Wor-rikul." The wild dog species was "Mur-rong-kai," "Yu-ki" being the wild native dog and "Mir-ri" the wild native bitch.

The term "Yaraman" for horse was widespread. In Kamilaroi, according to Ridley, "Yaraman" was derived either from the sound of the neighing of the horse or was in allusion to its large and powerful teeth. ("Yira" or "Yera"—teeth, and "Man"—with). The same name, however, occurs in the George's River, Appin and Cowpasture language, where it is interpreted as being derived from "Yarra" to throw fast.

As is only to be expected, many of the terms in En-nee-win, Ngarrabul, Pikumbul and Yookumbul are very similar, if not quite identical. Others, however, are quite distinct, so that throughout Australia there was a perfect babel of tongues. It is exceedingly interesting to note, in spite of many conspicuous divergencies, the connection by points of similarity between the languages of the native tribes separated from each other by many hundreds of miles of territory. The onomatopœic designations are of special interest. In this connection I might quote also the name "Warreet" given to me many years ago by an aboriginal on the Barrington River, New South Wales, for the Blue Mountain Parrakeet (*Trichoglossus moluccanus*—Gmelin). This excellently imitates the screeching cry of the bird. It seems to me a pity not to preserve as far as possible the native names for the various animals and plants, and, where practicable, popularise them as preferable to the clumsily manufactured ones accepted in authoritative works. A fish which I did not identify was very many years ago termed for me "Goo-al" by a La Perouse aboriginal. Surely such a word is brief enough and sufficiently euphonious to be perpetuated as a popular name.

## THE LORICATES OF THE NEW CALEDONIAN REGION.

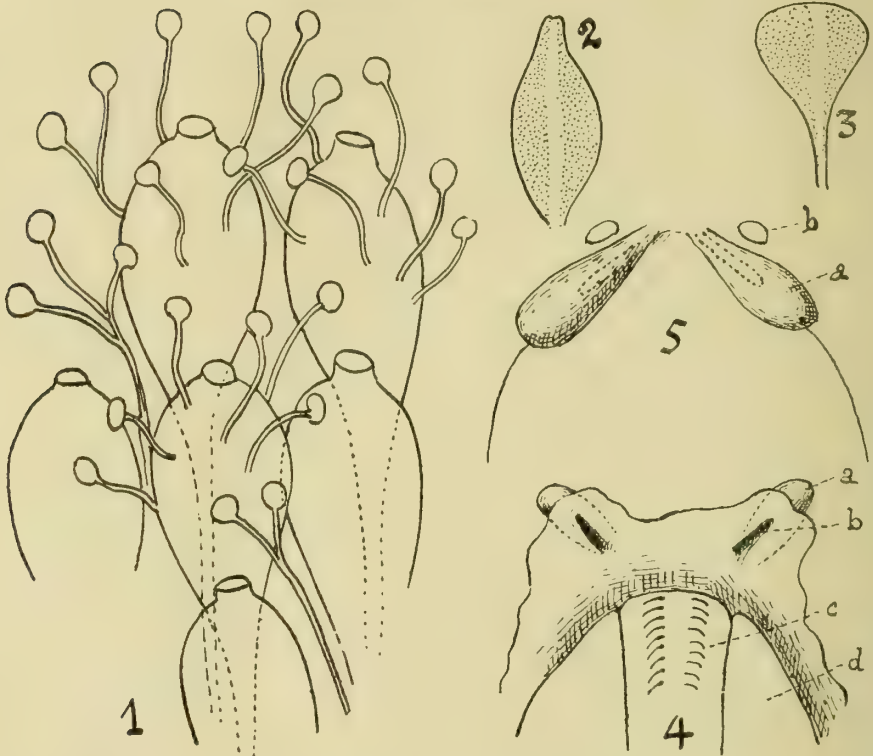
(Class MOLLUSCA—Order LORICATA).

By A. F. BASSET HULL and JEAN RISBEC, D.Sc.

## II.

Plate xxxi.

ISCHNOCHITON ACOMPHUS H. &amp; R.

*Explanation of Figures.*

1. Megalaesthetes and microaesthetes—magnification 1300.
- 2 & 3. Microaesthetes greatly magnified—magnification 4500.
4. Oesophageal wall thrown back in front to the level of the anterior end of the radula. (a) salivary gland. (b) orifice of the salivary gland. (c) radula. (d) sub-radular bulb.
5. Salivary glands viewed dorsally in their normal position. (a) salivary gland. (b) buccal ganglion. (This ganglion is found in front of the gland, and underneath, in consequence of the position of the oesophageal wall, which at this level is nearly vertical above the mouth).



Since the publication of the first part of this paper it has been possible to make the following observations regarding this species:—

*Salivary glands.* These glands open into the anterior portion of the digestive tube. They are quite simple, in shape, like the slightly enlarged finger of a glove; in colour they are white. They discharge in front of the anterior part of the sub-radular bulb, through two large orifices in the form of slits. They are found a little in front of the posterior edge of the first valve of the shell, and as they are situated quite close to this valve are easily extracted when the valve is removed. The two glands are close to each other at their base, and the white tissues of the glands will, when stretched out, nearly join again on the median line.

*Sensory organs of the shell.* *Ischnochiton acomphus* does not possess any ocelli. It is abundantly provided with megalæsthetes and micraesthetes. The megalæsthetes are spindle-shaped, and their average measurement is 26 $\mu$ . The micraesthetes spring from the megalæsthetes, or even form separate bunches. The nerves proceeding from the megalæsthetes may nevertheless inter-ramify them. The micraesthetes measure 4 $\mu$ .

*Reproduction.* Fresh observations confirm the fact that the extrusion of eggs is effected at periods quite unconnected with lunar changes. Thus after the full moon of the 8th September, 1930, eggs were extruded on the 9th, then on the 12th, and finally on the 16th of that month. The "laying" of the 16th was very abundant, about 300 eggs being counted.

## II. Family LEPIDOPLEURIDAE.

### ii. Genus PARACHITON Thiele, 1909.

#### 2. PARACHITON LIFUENSIS n. sp.

Plate xxxi., figs. 1-7.

##### (a). *The Shell.*

Shell small, narrow, round-backed, moderately elevated, side slopes rounded, not keeled. Colour, creamy buff, sometimes maculated with reddish. Sculpture uniformly grain-striate.

Anterior valve very finely closely rayed, and having a distinct marginal growth ridge.

Median valves: Lateral areas raised, clearly differentiated, radially grain-striate, the rays crossed by eight to ten low growth lines or folds, terminating in a marginal ridge; central areas with about forty straight longitudinal rows of granules, sometimes coalescing, the granules larger than those on the lateral areas.

Posterior valve large; mucro sharp and situated almost above the posterior margin; postmucronal slope steep, convex; post-mucronal area very small; ante-mucronal area very large; the sculpture of the whole valve resembling that of the anterior valve, but granules larger, increasing in size, and radiating outwards towards the margin. Girdle densely clothed with fine elongate glassy spicules, projecting at margins.

Interior pearly white; sutural laminae large, distant.

Dimensions: 15 x 6 mm. (type, dried and somewhat curled).

Station: On or under dead coral or stones, below low water mark.

Habitat: Loyalty Islands, Lifu (3 examples, Hull), Ile Mouac (1 example, Risbec).

Remarks: This shell is characteristic of the Australasian species of the genus, and is closely allied to *P. puppis* Hull, from Port Jackson, although quite easily separated, especially in life, by the distinctive coloration and coarser sculpture.

(b). *The Animal.*

*External characters.* The foot is narrow, ivory colour, and less than one-third of the size of the whole animal. The mouth is supported by a strong projection, rounded in front, and truncated behind in a half-moon. This projection is enframed in front and laterally by a folded hood. The anus, situated above the posterior termination of the foot, is supported by a slightly projecting tube. The gill-rows at the sides of the foot only extend over the lower half of that organ. In the single example available for study, 17 gills were counted on each side; it is probable that this number varies a little in different specimens. The gills are very wide, their size being included in this instance in a plane perpendicular to the longitudinal axis of the animal.

*Digestive apparatus.* The papillary sacs are well developed, and show thick short papillae, widened at the head. The heads of the papillae are compressed against each other (fig. 4). The sub-radular organ, situated very near the mouth, is well developed, and consists of two lateral masses. The radula shows 44 fully developed rows, and 10 rows in course of formation. The central tooth is narrow, and bears a very slightly recurved cusp. The second lateral is strongly developed, massive, with three weak points, its base showing a supplementary apophysis. The projecting palette which follows the fourth lateral is irregularly developed and the widened part is lacking in certain rows. The radular teeth are very elastic, and of a cartilaginous consistency. One can distort them easily without breaking them.

*Sensory organs of the shell.* Observations were made in respect of a shell which had been dried for a long time, and was merely decalcified. There are no ocelli. The disposition of the megalæsthetes and micraesthetes is most remarkable. The megalæsthetes are arranged very regularly in rows. Each of these organs is swollen like an amphora, and its very short neck terminates in a rather large megalopore. Each megalæsthetete bears only two micraesthetes with very short peduncles, arranged quite regularly to right and left.

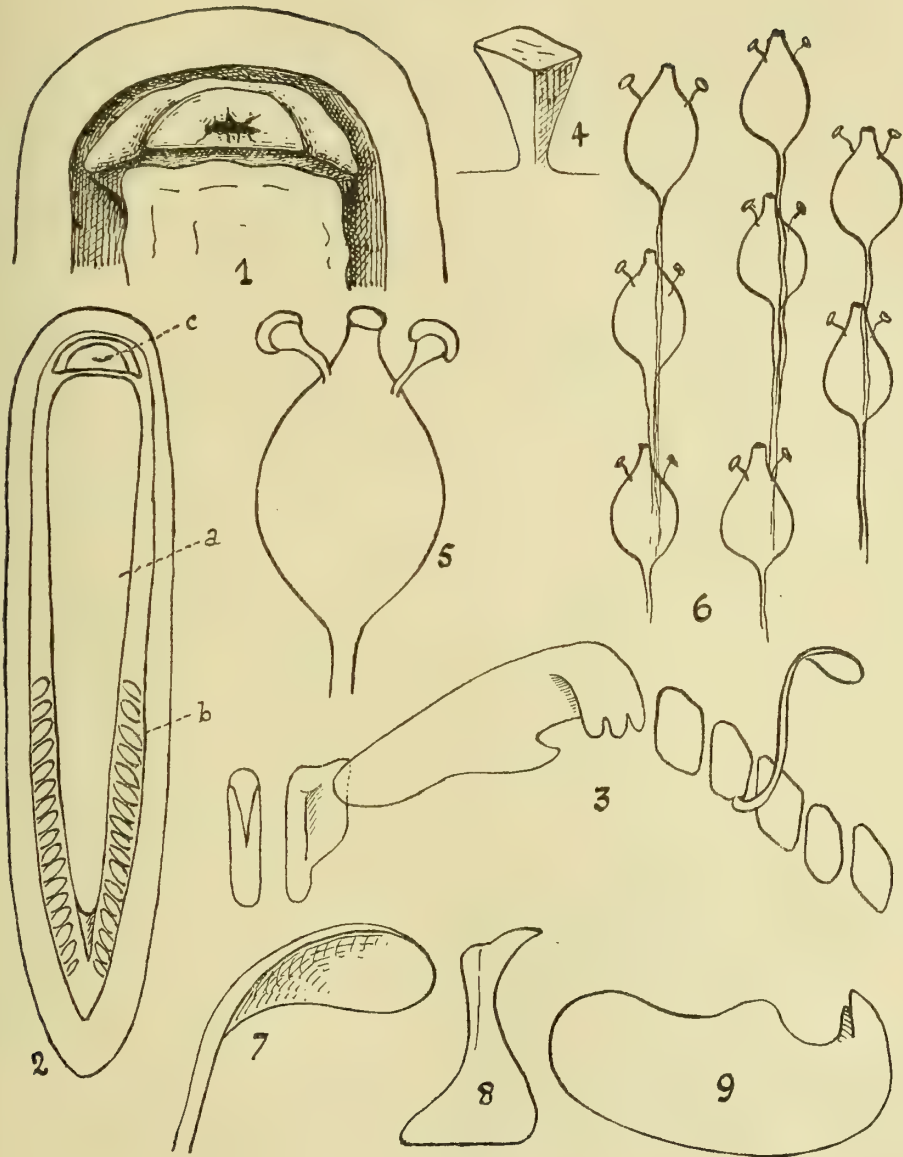
(Note: Only one animal having been available for dissection, it has not been possible to furnish a description of the other organs).

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*Parachiton lifuensis.* *Explanation of Figures.*

(See opposite.)

1. Anterior portion of the animal viewed ventrally.
2. The whole animal viewed ventrally. (a) foot. (b) gills. (c) mouth.
3. One half of a radular row—magnification 250.
4. Single papilla of a papillary sac.
5. Single megalæsthetete and its micraesthetes—magnification 1200.
6. The whole of the sensory organs in one part of the shell, showing the very characteristic arrangement of the megalæsthetes—magnification 42.
7. Free extremity of the radular hook, situated at the exterior of the 4th lateral.
8. Central tooth, side view.
9. A view of the 2nd lateral.



*Parachiton lifuensis* H. & R.

## III. Family CALLISTOCHITONIDAE.

## iii. Genus LOPHOCHITON Ashby, 1923.

## 3. LOPHOCHITON GRANIFER (Hull).

*Callistochiton granifer* Hull, Aust. Zool., iii., 1923, 161, pl. xxv., figs. 5-8.

Palm Islands, Queensland. Type in Australian Museum.

*Lophochiton granifer* (Hull), Iredale & Hull, Aust. Zool., iii., 1925, 356, pl. xl., figs. 9-13.

Three examples only of this shell were collected, two near Onen Toro (S.W.) and one at Ichio (East Coast). It is not considered necessary to add anything to the shell descriptions already published in this journal, but the following observations made from a dried shell relate to the

*Sensory organs of the shell.*  
(Observations made from a dried shell). The arrangement is confused and difficult to study. There are no ocelli. The megalaesthetes are elongated, and each one bears numerous microaesthetes (see fig). The microaesthetes have elongated peduncles.

Megalaesthetes and microaesthetes  
—magnification 1000.



## IV. Family CRYPTOCONCHIDAE.

## iv. Genus ACANTHOCHITON Gray, 1821.

## 4. ACANTHOCHITON CURIOSUS Iredale &amp; Hull.

*Acanthochiton curiosus* Iredale & Hull, Aust. Zool., iv., 1925,

87, pl. x., fig. 24, 25. Armit Island. Type in Queensland Museum.

This shell is not common, but four examples were taken on Ile aux Canards, near Noumea. Its station there was similar to that in its Queensland habitat, being under pieces of dead coral lying in muddy sand. When found, these four shells were under coral completely exposed and dry on the surface, the tide having receded, but there was plenty of moisture underneath to keep the girdles supplied with water.



It has not been possible to make an anatomical study of this species. Observations have only been made on the radula, and the specimen used had long been dried. This radula shows no important difference from that of *A. tridacna*. The central tooth, however, is narrower, and its free surface bears a crest with its principal projection directed towards the front; this condition being the opposite of that which is generally observed; but it must be pointed out that there is no question here of a true cusp. The first lateral is better developed and more extended transversely. The other teeth do not call for particular mention.



*Acanthochiton curiosus*.

One half of a radular row—magnification 200.

[*ACANTHOCHITON BELLIGNYI* Rochebrune.

*Acanthochites bellignyi* Rochebr., Bull. Soc. Philom. Paris, 1883-4, 37. New Caledonia. Type in Paris Museum.

*Acanthochites bellignyi* Rochebr., Pilsbry, Man. Conch., xv., 1893, 29.

Pilsbry's translation of Rochebrune's description is as follows:—"Shell elongated; ashen, marbled with white and tawny. Anterior valve rounded elliptical, posterior very minute; intermediate valves having the central areas smooth, lateral areas concentrically scaly, scales spatuliform. Marginal ligament rather wide, brown, with 9 blue bunches. Length 15, breadth 8 mill."

Mr. Tom Iredale, who has seen the so-called type shell in the Paris Museum, states that it appears to be of the *A. zelandicus* group. He does not think it is a New Caledonian shell. As we have failed to find any *Acanthochiton* resembling even remotely Rochebrune's shell, we merely record it here, and concur with Iredale as to the locality assigned being erroneous.]

## V. GENUS LOBOPLAX Pilsbry, 1893.

## 5. LOBOPLAX TRIDACNA Rochebrune.

Plate xxxi., figs. 8-15.

*Acanthochites tridacna* Rochebr., Bull. Soc. Phil. Paris, 1880-1, 121.*Acanthochites (Loboplax) tridacna* Rochebrune, Pilsbry, Man. Conch., xv., 1893, 40.*Loboplax tridacna* (Rochebrune) Thiele, Rev. Syst. Chitonon I., in Chun's Zoologica, Heft 56, 1909, 38, pl. v., figs. 22-31.

Pilsbry's translation of Rochebrune's description is as follows:—

"Shell ovate-elongate, white, shining. Anterior valve rounded, strongly 7-lirate radially, the lirae thick, rounded, scaly, elevated in front. Intermediate valves broadly triangular, the central areas longitudinally striated at the apices, scaly at the sides; lateral areas bi-lirate, the lirae scaly. Posterior valve very small, nearly concealed, subquadrate, bi-lirate. Girdle wide, grey, pilose, clothed with whitish down; tufts 9, white, glassy.

"Length 27, breadth 16 mm.

"New Caledonia (Presented to the Paris Museum by the Colonial Museum)."

Pilsbry adds: "This is evidently a form allied to *A. violaceus* and *A. costatus*. The seven anterior ribs mentioned evidently include the sutural margins, the number five being constant in this group."

Thiele, having the type before him, redescribed and figured this shell.

For the purpose of maintaining a uniform mode of description in this work, we submit a further redescription.

Shell medium, elongate, narrow, elevated, carinated, side slopes convex. Colour generally creamy white, the prominent sculptured ribs shining white; occasionally greenish, the ribs and jugal area being deep green.

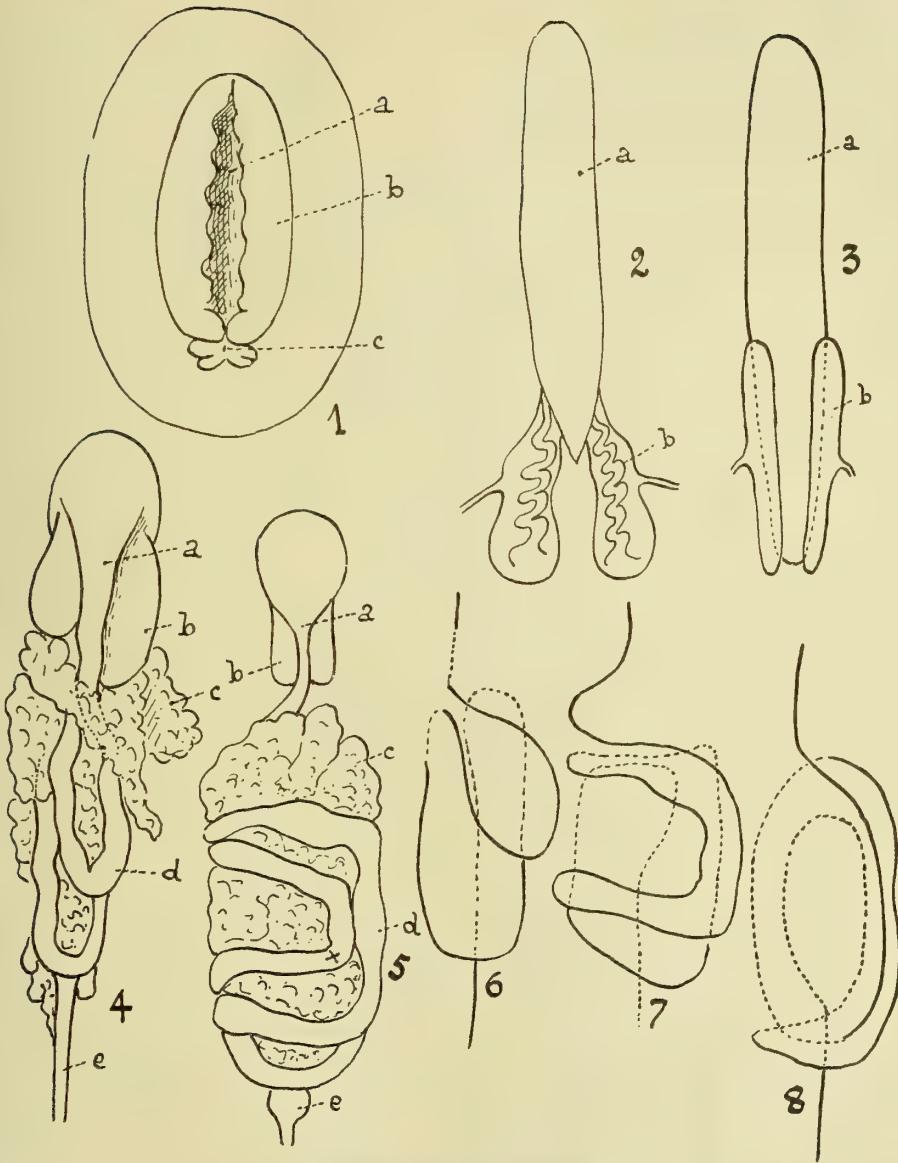
Anterior valve with five very prominent ribs formed by white, shining, rounded pustules, becoming obsolete at the apex, and increasing rapidly in size towards the anterior margin and projecting over the girdle, giving the margin a scalloped appearance; the spaces between the ribs covered with small rounded pustules.

Median valves strongly beaked, covered, except as regards the jugum, with numerous large, rounded pustules, and having a very strong diagonal formed of prominent shining pustules, similar to those forming the ribs on the anterior valve; the pustulose sculpture diminishes rapidly towards the jugum, and there becomes longitudinally grain-striate.

*Explanation of Figures.*

(See opposite.)

1. Ventral view of the animal, partly retracted—magnification 10. (a) partly enclosed foot. (b) swollen hairy cushions. (c) cushions surrounding the anus.
2. Male genitalia. (a) gland. (b) colourless sac from whence the evacuating canal proceeds.
3. Another arrangement of the same. Lettering as above.
4. The whole digestive apparatus. (a) oesophagus. (b) papillary sac. (c) liver. (d) intestine. (e) rectum. Magnification about 10.
5. The whole digestive apparatus from another specimen. Lettering as above.
- 6, 7, & 8. Diagrams showing differing arrangements of the digestive tube; the visible portions of the digestive tube when this organ is viewed under the conditions shown in figs. 4 and 5 are drawn in unbroken lines, the hidden parts in dotted lines.

*Loboplax tridacna* (Rochebr.)

Posterior valve small, the mucro at the posterior margin and projecting over the girdle; post-mucronal area having 5 heavy pustulose, recurved ribs, the two anterior ones branching outwards and forming a diagonal like those of the median valves, separating the ante-mucronal from the post-mucronal area, the former being disproportionately large, and sculptured with rounded pustules, similar to those of the central areas of the median valves.

Girdle wide, spongy, covered with fine glassy spicules above, and with minute imbricating scales on the underside. Sutural tufts large, white, eight on each side, and two in front of the anterior valve.

Interior pearly-white or greenish, according to the exterior colour or the shell. Slits 5—1—5, the teeth of the tail valve very thick and blunt.

Dimensions (of shell described): 24 x 10 mm. (dried and somewhat curled). In life the girdle is as wide as the exposed portion of the shell.

Station: On the underside of stones or dead coral, below low water mark.

Habitat: New Caledonia.

Remarks: This shell is not uncommon in the vicinity of Noumea, many specimens having been collected on Ile Brun at the entrance to the harbour. Its nearest ally is *A. leuconotus* Hedley & Hull, from Lord Howe Island, from which it differs principally in the much coarser sculpture, and the remarkable shape of the posterior valve. Two forms exist, one as described, the other narrower, and with notably finer sculpture, in this respect approaching still closer to *A. leuconotus*, but the posterior valve remains a marked differentiating feature. This second form is generally of a greenish colour. Both forms are figured.

(b). *The Animal.*

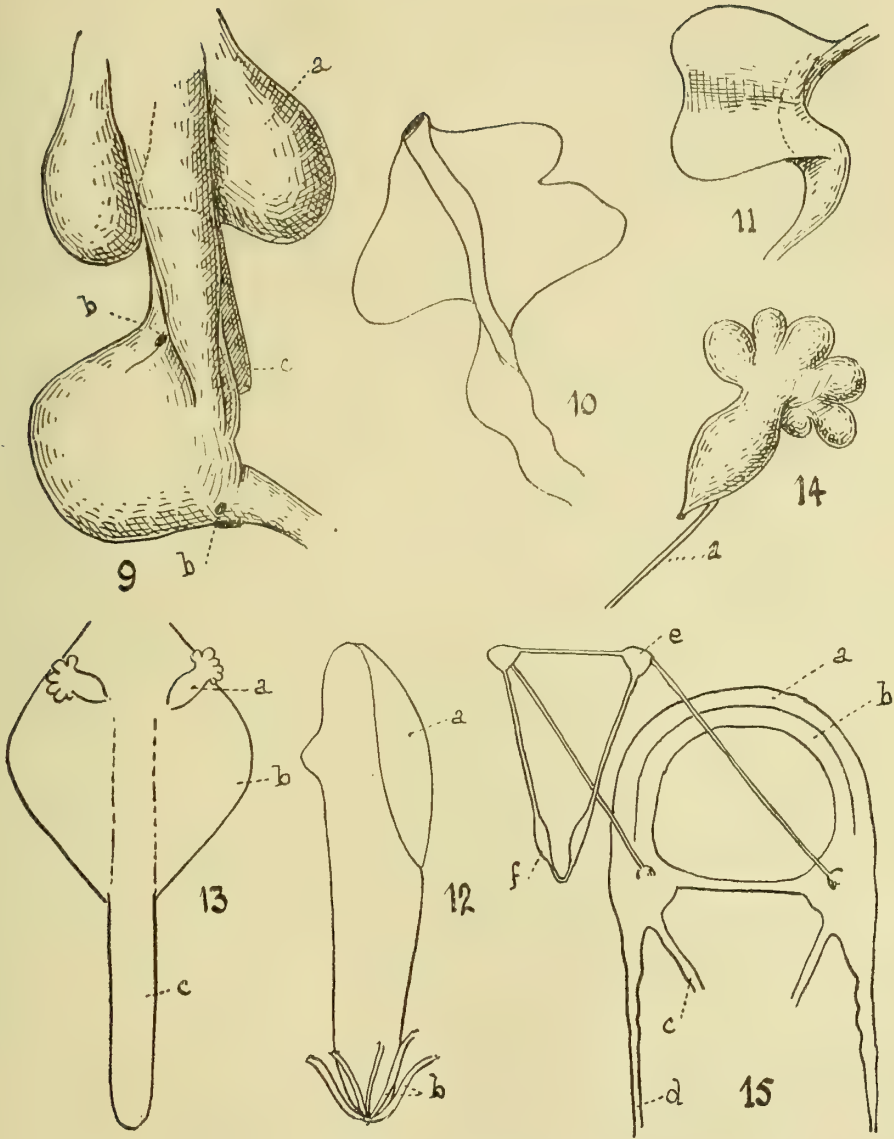
*External characters.* The foot is narrow and ivory-coloured. On examining the ventral surface of an example detached from its resting place, the aspect indicated by fig. 1 is obtained. On the inner margin of the girdle there is a series of thick cushions with a hairy appearance. Two of these cushions, the most important, frame the foot to right and left in such a manner that this organ is deeply imbedded. The gills are thus invisible, since the sides of the foot themselves are covered. The mouth is surrounded, as in *Ischnochiton acomphus*, by a projecting ledge, and is also completely invisible. The anus is surrounded by four hairy nipples. The arrangement of the gills is extremely variable in different specimens; the

*Explanation of Figures.*

(See opposite.)

9. Anterior region of the digestive tube. (a) papillary sac. (b) hepatic orifice. (c) radular sac—magnification 35.
10. The liver raised; the stomach turned to the left 90°; the intestine remaining in position.
11. Left side of the stomach.
12. Cartilage of the buccal bulb. (a) thick white region. (b) muscles—magnification 70.
13. Semi-diagrammatic design showing the arrangement of the salivary gland above and in front of the bulb. (a) salivary gland. (b) buccal bulb. (c) radular sac.
14. Detached salivary gland. (a) stomato-gastric connective. The buccal ganglion is hidden by the gland.
15. Entire nervous system. (a) & (b) cerebral arches. (c) pedal nerve ribbon. (d) pallial ribbon. (e) buccal ganglion. (f) nerve ganglion.





*Loboplax tridacna* (Rochebr.)

gills are always few in number—7 to 9 on each side. It would appear that as the size of individuals, that is to say their growth expansion, increases, the gill mass is adjusted to occupy a progressively diminishing portion of the body length; it is, of course, always situated in the posterior zone. It can therefore be seen that the gills extend over the posterior half of the foot, or a lesser part, even as little as one-third of its length. The gill-rows of one side are shown in fig. 16. They are regularly crescent-shaped, running from front to back, the points being directed towards the foot, and are closely coupled. In the example which possessed nine gills on each side, the first was the smallest.

*Digestive apparatus.* As appears to be customary among the Loricates, the digestive tubes of the examples examined showed great variation. The arrangement of the intestinal canals does not appear to follow any rule. Figs. 4 and 5 show two very different types of system. In the first case the buccal bulb and the papillary sacs are relatively well developed, while the intestinal coils are simple; in the second case, the contrary obtains, in that the region of the bulb is attenuated, compared with that of the intestine.

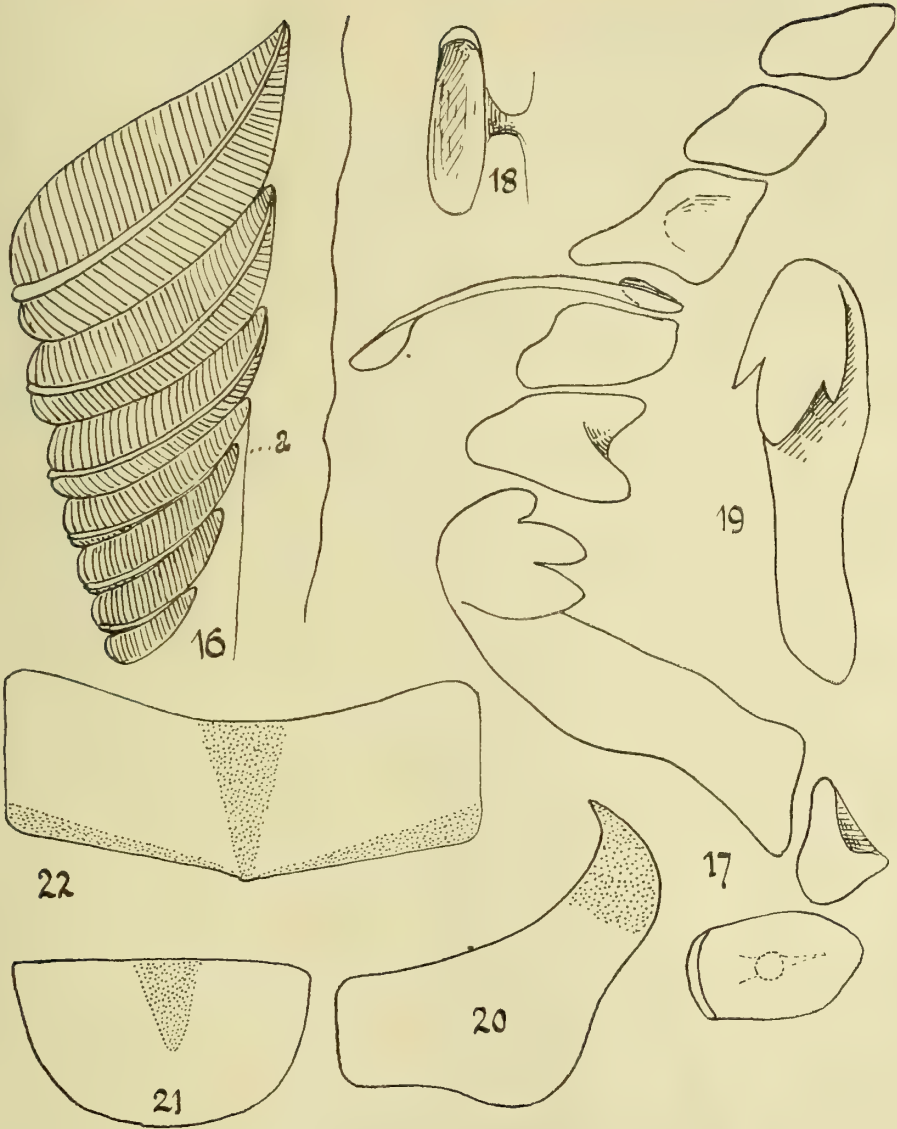
The diagrams in figs. 6, 7 and 8 show the course of the digestive tubes in three different individuals (with those parts which are hidden by the liver shown by dotted lines) and also demonstrate those important differences which can be seen in the arrangement of the intestine. The strongly developed buccal tube is usually hidden by the anterior part of the oesophagus, and by the papillary sacs. The general arrangement of the muscles is governed by the development of the two cartilages shown in fig. 12. These cartilages are translucent, with a more opaque swollen fusiform portion towards the head and the dorsal side, and into the gradually diminishing posterior part are inserted the greater portion of the muscular fibres of the bulb. The radular sac is short; the number of fully developed rows is approximately 40. The central tooth of each row is very remarkable. In order fully to understand its construction, a lateral view of it is shown in fig. 18. It is very weak, transparent and easily distorted (elastic). It is shaped like a mushroom with a slender peduncle supporting a concave oval plate in its central zone, and displaying a projecting ledge in front. The small first lateral projects in the form of a triangle. The powerful second lateral is tricuspid. The third and fourth laterals show very great differences in appearance, according to the manner in which they are viewed under the microscope. Both have a strong projecting crest on the basal plate. The projecting palette which follows the fourth lateral is plainly situated at the exterior of this tooth. In *Ischnochiton acomphus* this palette is placed rather behind the fourth lateral and turns round this tooth until it approaches the interior face of it (towards the axis of the radula). The other radular teeth do not show any noteworthy characters. The radular sac is enclosed first by the papillary sacs towards the upper side and laterally, second by the oesophagus at the top, and third by the hepatic lobe placed under the stomach to the left and

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*Explanation of Figures.*

(See opposite.)

16. Complete gill-row on one side of the body. (a) margin of the foot.
17. One half of a radular row—magnification 420.
18. Central radular tooth, three-quarter view.
- 19 & 20. Two views of the 2nd radular lateral.
21. Diagram indicating the distribution of the sensory organs on the posterior valve, these organs occupying the dotted regions.
22. Distribution of the sensory organs on the median valves.



*Loboplax tridacna* (Rochebr.)

towards the under part. It is sulphur-yellow in colour. The oesophagus receives two small symmetrically arranged glands at its most anterior point and at the level of the anterior extremity of the radula. Each of these glands occupies the anterior angle of the stomato-gastric nervous system, and conceals the anterior ganglion of this system. It is in *Acanthochiton* that one finds these glands in their most characteristic form. The canal is considerably swollen and ovoid, and at its distal extremity six glandular bodies are grouped, displaying a regularly palmate arrangement. These glands are ivory-coloured, of small size, and easily escape notice, because they are situated so much in front in a region where numerous muscles are interlaced. The papillary sacs display a development and arrangement varying greatly in individual examples. In the animal represented by fig. 9 the right papillary sac is much more developed than the left; it extends a considerable distance towards the under side, as indicated by dotted lines. In the case of the animal represented by fig. 5, the two sacs, greatly reduced, are symmetrical. In every case the sacs contain very long fringed papillae, and present a bristling appearance, due to the emission of secretions. After a very short distance the oesophagus becomes enlarged into a stomach. While it is not possible to lay down a general rule, it seems that the development of this organ is in inverse ratio to that of the papillary sacs; that is to say that when the sacs are relatively well developed, the stomach is more reduced. In the case of the example shown in fig. 9, the stomach, simple in form, receives the hepatic tubes at two opposite points, at the entrance and at the outlet of the organ. The example represented by fig. 5 shows a stomach of a much more complex form. This organ is hidden in fig. 5 by the front lobes of the liver. Fig. 10 shows it isolated and turned towards the left at an angle of 90°. Fig. 11 shows another aspect of this stomach; the visible side in this figure is the left side which shows a track corresponding to the impression of the hepatic lobe. From the stomach and up to the position marked on the intestine by a cross in fig. 5 one finds in the interior of the intestine a thick, white, opaque plate, detached from the side, and which seems to be intended to direct the food. From the place where this plate disappears, the intestine, instead of being grey, shows a blackish colour. The very irregular liver shows lobes of a light greyish colour. The terminal portion of the rectum is sometimes swollen into a blister, but this condition is not constant.

*Nervous system.* In the whole of the anterior zone where the cerebral and pedal cords surround the buccal orifice, these cords, relatively very large, are closely coupled. They constitute, at the point where they divide, an important nerve-mass on each side; the two masses being united by a commissure. The well-developed pallear cords show at their points of origin a series of successive fusiform swellings. The pedal cords are a little less strong, and come together mutually to follow the lateral parts of the foot. Connectives proceed from the palleo-pedal ganglion masses to the ganglia placed at the anterior portion of the oesophagus. These ganglia are in the shape of flattened tetrahedrons. They are connected by an anterior commissure which is in a sense a collar which surrounds the oesophagus and which bears two fusiform ganglionic swellings. As to the details of difference, the arrangement is nearly the same as in *Ischnochiton acomphus*. Further, in the Loricates the nerve organs seem to show a similar constitution in the various species, and do not show individual variations worthy of notice.

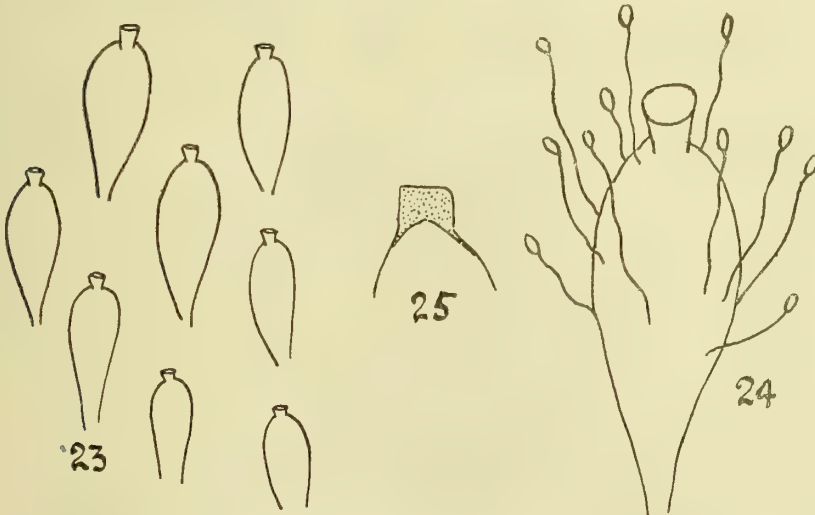
*Reproductive organs.* The genital organ is white in the male, ivory-coloured in the female. In both instances it is placed dorsally, above the digestive organs. It projects in front up to the posterior portion of the



bulb. Its form is not constant, but is always that of a rather irregular narrow sac. The eggs are arranged on the transverse folds of the side of the organ. They fall into two lateral pockets, situated either behind the organ (fig. 2) or in such a manner as to cover the posterior portion of the organ by projecting more towards the front. These pockets are whitish on one side, with spiral projections from the side, giving the appearance of a specialised conduit.

*Circulatory system.* The heart is transparent, situated right at the back, presenting the usual arrangement of two auricles on each side.

*Sensory organs of the shell.* The shell does not display any ocelli. If one is satisfied merely to study a decalcified shell the presence of a thick epidermis, dirty, and overgrown with algal threads, renders any useful observations impossible. Even suitable areas, which have an appearance as of unpolished glass, only allow unpigmented megalaesthetes to be seen. For a complete study, the shells were treated in the following manner:—Ten minute's immersion in boiling caustic soda, then in diluted hydrochloric acid until decalcified, after which they were stained with eosine. The megalaesthetes are only distributed over certain special areas of the valves; they have not been found on the anterior valve. The posterior valve only shows them in the ante-mucronal area. The median valves have megalaesthetes in the middle of the central areas and in the lateral areas. The diagrams (figs. 21 and 22) indicate by dotted areas the distribution of these sensory organs. In the central areas the megalaesthetes are directed from the front towards the back—that is to say, the nerve comes from the front, while the megalopore is posterior. In the lateral areas the nerves come from the outer side. In the central areas, which together form a median



*Loboplax tridacna* (Rochebr.)

23. Diagram indicating the relative positions of the megalaesthetes.

24. Megalaesthetes and microaesthetes—magnification 1400.

25. Appearance frequently presented by the terminal extremity of the megalaesthetes.

band along the whole length of the carapace, the megalæsthetes are rather numerous and crowded; fig. 23 gives an idea of the manner in which they are distributed. They form rather regular longitudinal lines. In each of these lines there are fifteen megalæsthetes to a valve. The central area of a valve contains from 150 to 250 of these organs. The lateral areas are far less well supplied. The shape of the organs is sufficiently well indicated in fig. 24. Fig. 25 gives an aspect often presented by the region of the megalopores under preparation. The micraesthetes are very irregularly distributed; they are small ovals with a very fine and long nerve. The average length of a megalæsthete from its megalopore to its posterior contraction is, on an average,  $42\mu$ .

#### EXPLANATION OF PLATE XXXI.

- Fig. 1. *Parachiton lifuensis* Hull & Risbec, whole shell.  
 .. 2. *Parachiton lifuensis* Hull & Risbec, anterior valve.  
 .. 3. *Parachiton lifuensis* Hull & Risbec, one-half median valve.  
 .. 4. *Parachiton lifuensis* Hull & Risbec, posterior valve.  
 .. 5. *Parachiton lifuensis* Hull & Risbec, interior of anterior valve.  
 .. 6. *Parachiton lifuensis* Hull & Risbec, interior of median valve.  
 .. 7. *Parachiton lifuensis* Hull & Risbec, interior of posterior valve.  
 .. 8. *Loboplax tridacna* (Rochebr.), coarsely sculptured form.  
 .. 9. *Loboplax tridacna* (Rochebr.), finely sculptured form.  
 .. 10. *Loboplax tridacna* (Rochebr.), anterior valve.  
 .. 11. *Loboplax tridacna* (Rochebr.), one-half median valve.  
 .. 12. *Loboplax tridacna* (Rochebr.), posterior valve.  
 .. 13. *Loboplax tridacna* (Rochebr.), interior of anterior valve.  
 .. 14. *Loboplax tridacna* (Rochebr.), interior of median valve.  
 .. 15. *Loboplax tridacna* (Rochebr.), interior of posterior valve.

#### A NEW SPECIES OF STIGMODERA (BUPRESTIDAE).

By H. J. CARTER, B.A., F.E.S.

##### STIGMODERA (CASTIARINA) CALLUBRIENSIS n.sp.

Elongate oval. Head, pronotum, scutellum and apex of elytra (narrowly) violet bronze, whole underside more coppery than violet; elytra testaceous with extreme apex dark.

Head densely punctate, deeply excavate and channelled between eyes.

Prothorax rather flat, widest at base, thence arcuately narrowed to apex without sinuation, apex truncate, base moderately bisinuate, anterior angles obtuse, posterior acute; whole surface uniformly, densely and finely punctate, with well-defined medial sulcus throughout, medio-basal area slightly depressed, without basal foveae.

Elytra lightly widened at shoulders and compressed behind them, apices with a rather wide semicircular lunation, bounded by two rather long external spines; margins entire; striate-punctate, the medial intervals flat, the lateral very lightly convex, each with a row of close punctures. Under-side, especially prosternum, strongly and densely punctate, a fine pubescence visible towards sides.

Dimensions: 9 x 4 mm.

Habitat: New South Wales, Bogan River (Mr. I. Armstrong).

A single ♀ example was taken by Mr. Armstrong, of Callubri Station, and generously presented to me for description. In my re-tabulation (see ante, p. 349), it can only be confused with *phaeorrhea* Kirby and *luteipennis* C. & G. The latter is easily separated by larger size, convex elytral intervals and unarmed apices; the former by its green prothorax, elytra with apical two-thirds dark, and apices having the sutural spine pronounced. Holotype in Coll. Carter.

## MISCELLANEOUS NOTES ON MONOTREMES.

By HARRY BURRELL, C.M.Z.S.

In *The Platypus* (page 53) I touched on the remarkable transformation that takes place in the fore-claws of *Ornithorhynchus anatinus* during their growth, but at that time I had little knowledge of their structure. Since then, however, I have gone more fully into the matter, with the following results:—Some years ago, while engaged preparing intra-uterine material for the late Professor Launelot Harrison, being pressed for time, I was compelled to bury a skinned carcase of an adult female platypus. It was placed in a clean, air-tight tin.

Exactly five years afterwards I exhumed the remains, which consisted of a complete bony skeleton and skull. That is to say, with the exception of one rapidly deteriorating front claw nail (out of twenty nails) nothing but true bone stood the test of time. Even the false teeth, which replace the true teeth of immature specimens, had completely disappeared, thus proving beyond doubt the fragility of their composition, at least when disconnected from their sockets.

The fragile remains of the solitary claw nail (which fell to pieces while being handled) resembled a curled scale of a small fish, and was just as thin. This was all that remained of a fully matured nail which, obviously, represented the veneer-like upper surface of that member only. The rest, comprising the bulk, had already powdered away, leaving the bone of the claw as sound as the knuckle-bone. This claw-bone, though less curved, and, of course, uniformly larger, was exactly similar to the nailless claw of a nude nestling. It was accurately shaped at the base for the purpose of fitting on to the knuckle-bone, but more deeply grooved beneath, to allow for the gradual growth of its sinewy attachments. These conditions, I find, hold good with the claws of the feet and the hands alike, but are far more conspicuous in every respect in the make-up of the latter. In the very young, when the nail is forming over the bone, it appears to be of a gelatinous nature, and seemingly grows down gradually, as a quick, from the base of the bone, beneath the veneering. This veneering appears to be attached to the leathery covering of the otherwise bare knuckles or toes, as the case may be. However, it grows simultaneously around the bone, though obviously at a lesser rate beneath it, and, like a human nail, becomes hard and somewhat brittle with age. When matured it is almost as long again, and fully four times that in bulk (width and breadth) as its foundation bone. This quickening of tissue is exceptionally gradual during the secondary foetus stage. That is to say, after leaving the egg and while it is being continuously nursed by its mother for a fortnight, and has not yet tasted milk. After that, it is occasionally left alone for lengthy periods to sleep and grow in the nest, and this it does with greater rapidity than would be the case if it were more frequently disturbed to be suckled by the mother.

From that age on to a month later the embryo can be said to be a nestling, because prior to this it has never actually come into contact with nesting material. When about five weeks old, and coming into pelage, it commences to crawl about and scratch the loosened earth beneath the nest and around the cavity walls, considerably enlarging their dimensions. This deliberate delving, then, is the first essential exercise necessary for the development of the nails, and it is remarkable how soon the nails tend to take shape. Still, until the young are about three months old far more sleeping (of a lethargic nature) takes place than digging, or even dining. From then on, swimming, as well as burrowing forms part of their routine

work; but as most of this exercise is indulged in at dusk and dawn (if not throughout the night) under overhanging ledges, etc., observations of such exercises are seldom possible. Nevertheless, from what little I have observed in this direction, coupled with what I have ascertained from the movements of specimens of that age confined in a weanery, I am tempted to assert here that when a platypus is about four months old the claws are well set, both for swimming and burrowing. The assertion regarding swimming may seem strange, but I am certain that strenuous down-swimming (erroneously referred to as "diving") to the bed of a swollen river is practically impossible until the fore-claws assume their natural shape; otherwise, the swimming membrane, which projects well beyond the claw-tips, would receive punctures by being hard pressed against the downturned, sharp claws of immature specimens. (See *The Platypus*, plate 9).

I wish it to be understood that what I have mentioned above does not in any way conflict with the fact that nestlings can secure sufficient food-stuffs, including aquatic vegetation, in and about the shallows adjacent to their haunts, from the time they desert their nests (at the age of six weeks) until they attain the semi-matured age of four months. But as sleep is most essential during this period, especially for the first few weeks of it, little energy is spent; consequently, little food is required. By experimenting with twin nestlings (not a single specimen that may have been, on that account, gorged by the mother) I proved that they will not only live, but also grow (not fatten) for a month, under suitable treatment, and this without receiving any nourishment whatever other than mother's milk, which in this case they had received prior to the test. If this form of lethargy is not akin to reptilian nature it certainly is not bird-like, nor is it in keeping, as far as I am aware, with the traits of true mammals.

As previously stated, the transformation of the claw is very slow while the young are nude, or prior to the appearance of the pelage, but seeing that at the age of six weeks or thereabouts they would be commencing to dig and crawl about in their secondary haunts, I think about two months added to that period should prove ample time for the completion of the adult claw. Be that as it may, this I know:—When about twelve months old platypus are competent tunnellers. Now, to become so accomplished the creature must be in good condition, and, as such condition can only be brought about by the securing of suitable foodstuffs, most of which can only be obtained by strenuous swimming, is it not logical to surmise that a particular female specimen that furnished me with this information was neither a tyro nor a weakling?

In 1928, owing to a repetition of floods during the rutting season of *Ornithorhynchus*, in the rivers of the Manilla district (the Manilla and Namoi) I found to my astonishment that the females did not excavate any breeding burrows in their customary banks from which (season after season) I had unearthed specimens for various educational institutions. Owing to these conditions, the first in my experience, I was unable to collect suitable material for my requirements. Prior to this I had despatched by rail 300 miles a 500 lb. weight apparatus, which I term a "Weanery," to the field of contemplated action. All was in readiness weeks before the date I had set apart for the collecting of immature specimens for experimental purposes; but, unfortunately, I had counted my monotremes before they were hatched, and consequently was compelled to place the weanery under canvas for 12 months.

The following year (1929) proved to be an ideal season for platypus, as also, by the way, appeared the previous nesting season; but on this later occasion the winter rains had not been at all severe during the rut, a fact



which strengthened somewhat my earlier theory that the floods of 1928 had interfered considerably with the early copulating of couples in the locality. However, although I was convinced that my previous prediction was not wrong, I was perhaps over-anxious this season to test a new bank of the Manilla River, where an entrance to a burrow appeared to be more than the mere temporary variety of the previous year; and as it was well off my customary beat I decided to make investigations sixteen days earlier than the date I usually set apart for this collecting of nestlings at a given age.

So, as an experiment for the season, on the 22nd of October investigations were made, and after following the tunnel for about ten feet my assistant came upon a small female platypus in the act of excavating a terminal cavity. So unusual was this discovery that at the moment I felt really sorry for having disturbed her, especially as I did not then require adult specimens. Indeed, I meditated releasing her immediately, but on second thoughts I changed my mind (chiefly because of her very small dimensions and gentle demeanour) and decided to test her in the infant weanery. Admittedly, I had faint hopes of her living for any length of time in a contrivance designed solely for nestlings, as she had already tasted, and perhaps to the full, the pleasures of wild life, and consequently would fret (as brooding females always do) no matter how snug their new quarters may be; for I had not made provisions for any water other than that required for drinking purposes. However, when one sets out in earnest on research work, sentiment must necessarily be relegated to the background, so without further hesitation I adhered strictly to my second thoughts. But, as ill-luck would have it this platypus died, just when I was ready and most anxious to make use of her weanery stall for an experiment with a nestling taken from its mother.

The dead female measured fourteen inches from tip to tip, and on examining her reproductive organs, which showed signs of virginity, I came to the only conclusion possible, and that was (notwithstanding the floods referred to) that she was of the previous season's brood.

Now, providing she was hatched-out in the month of September, a month in which, probably, 90 % of platypus eggs are deposited in this locality, she would have been sixteen months old when taken from the burrow, and even if we go back to the earliest month in which eggs have been recorded (August) she would only have been seventeen months old; but the latest date recorded (November 6th) which appears to be most feasible in this instance, because of the hindrance caused by the early floods of the previous year, would make her twelve months old.

As against the measurement in length of this specimen (fourteen inches) a female (note sex) that I had fostered in the weanery for forty-seven days was thirteen inches long when she died at the age of three months. Compare these length measurements and you will find the creature that seemingly had enjoyed natural freedom, had grown in length one inch only in (say) twelve months. According to that rate of growth, if it be applicable throughout adult growth (a reasonable conjecture) up to the extreme measurement of twenty-four inches, then on attaining that length a fortunate male would probably be in a position to celebrate his twelfth birthday. How long he may live after the "celebration" I will endeavour to forecast:—

I have only once during my lengthy experience measured a male of the above dimensions, and he covered the twenty-four inches without being extended to the limit he could have stretched in life. His weight (after carrying two large grains of duck-shot in his thigh muscle, until mortification set in the flesh) was  $4\frac{1}{2}$  lb. How long he had carried the shot I

cannot say, but from the fact that a boy caught him by hand, in the act of crawling out of the river, it is safe to say he had lingered for several days before he was presented to me, and certainly such injuries would not tend to increase his weight.

Remembering how very few specimens have been recorded measuring in the vicinity of twenty-four inches (never exceeding this length), although a considerable number have been taken for scientific purposes alone for many years, I suggest that the life of *Ornithorhynchus* is about on a par with that of a dog—say up to fifteen years.

The reason that I have gone out of my way in an attempt to ascertain the longevity of *Ornithorhynchus*, is principally to satisfy persistent inquirers—how long do they live?—who for the past twenty years have pestered me with the only catch-question they can conjure up (after hearing me out on other points pertaining to platypus), and if I have failed in my attempt to satiate their curiosity, then I have at least put the onus of answering the question on to the shoulders of others. And why not?

Now, although length alone was sufficient to base the age of the fourteen inch specimen upon, the conditions of her reproductive organs were to be reckoned with also, and they, as I know them, coincided with what one would expect to find in a doubtful yearling. But whether or not I had correctly diagnosed their conditions is of little concern here, for according to my latest discovery of new-laid eggs (November 6th) even if she was not pregnant at the time she still had at least fifteen days (which I consider ample time) to be caught in a similar plight as the November brooder I unearthed that same season; and who can say that platypus do not lay both earlier and later than the dates of my recording? I wish it to be clearly understood here, that all of my research work has been linked up and based entirely on personal observations, and, practically speaking, restricted to one locality.

There is another point I would like to touch upon concerning this particular female, and it is this:—Her false teeth, both top and bottom sets, were fully formed and unblemished. This, then, reinforced by the fact that the true tooth of a three month's old specimen had disappeared in the process of natural shedding, should be sufficient evidence for one to assert that the shedding of true teeth and the development of false sets correspond with the period of transformation that has already been alluded to in connection with the maturing of the nails, i.e., four months. Accordingly, then, I am prepared to state that a platypus, apart from cohabiting, is fully equipped in every other particular to carry on alone until fully matured, even to the extent of self-preservation in time of flood. It may be that this seems astounding for a platypus at the age of four months, and especially if we consider the fact that weanery nestlings have not yet lost all of their true teeth, nor have they matured their nails, at the age of three months. But I believe that some allowance should be made for this, if only for the reasons that (1) in the first place they were not given any harsh foodstuffs that they may have otherwise procured had they been at large the while; and (2) in the second place, no hardened earth was at their disposal for muscular exercise and nail development, and this apart from the fact that swimming exercise also was denied them.

Earlier in this article I pointed out that the false teeth of platypus were extremely brittle in composition, and now I suggest that because of this frailty, it is futile to expect to unearth fossilised false teeth of some remote ancestral creature for the purpose of determining its relationship with our living fossil *Ornithorhynchus*. Nothing would be gained on this point, even if we found a complete skull of some adult ancestral type that

originally possessed teeth similar in composition to those peculiar to platypus. Moreover, the chances appear remote of finding fossilised true teeth of the immature platypus, unless they were fully calcified at the time of burial, a condition of dentition which, in the case of *Ornithorhynchus*, is no sooner perfected than the teeth are due for shedding.

Now, as determining relationship solely by dentition is practically impossible in this case, may I suggest that we should study the teeth sockets of fossils rather than the deciduous teeth of the living, or dentition dust of the dead. If the teeth sockets of *Ornithorhynchus* are unique in character—and I have an impression that they are, because of their specialised purpose of accommodating erratic deciduous teeth and false plates—then there should yet be some hope left for the student of comparative anatomy, if not for the field worker.

I propose now to touch on the subject of lethargy—at times confused with true hibernation—and wish to record that this state of sleeping is indulged in, at will, by both Monotremes, *Ornithorhynchus anatinus* and *Tachyglossus aculeatus* alike, and evidently at any time during their existence, and at any period of the year, according to the quantity of food available. For instance, if a flush, or, better still, repeated flushes in the river happen to wash away the food supply, without interfering with the burrows of *Ornithorhynchus*, the occupants of such places will simply curl up and sleep until such time as the river recedes and normal conditions return, even though several weeks may elapse before normality is reached. This will be more readily understood when I explain that foodstuffs include not only aquatic fauna, but also their hosts, aquatic vegetation, an essential factor without which the fauna in question would fare very poorly. Of course, the sleeper, which probably lives on the fat of its tail the while, falls away considerably during a lengthy period of lethargy, but it is surprising how quickly condition and strength are regained and maintained for the lean time to come. Here is an instance:—When Ellis Stanley Joseph, zoological collector, was experimenting with platypus in captivity at Granville, N.S.W., I was at his home one day supervising the construction of a portable contrivance for the purpose of housing a poorly conditioned specimen that both Mr. Joseph and myself considered, at the time, would probably not live through the night. When I first saw the creature it was shivering with fever or cold on a sand-bank and peering into a tank of water from which it had recently crawled. Seeing that it appeared to be quite unconscious of our presence, and even of its prison surroundings, I unearthed a few worms from the garden to test its appetite. On my return, some time later, I observed that it had not changed its previous position, and, if anything, its rigors were more pronounced than before. Leaning directly above the creature, I dropped some worms, one at a time, on to its beak, whence they would quickly wriggle away to sink in the water. At first the platypus apparently took no notice of me and my food contributions; in fact, it appeared to be too far gone to take notice of either movement, vibration, or sound, although all this was taking place in the open and in broad daylight, I consider such actions extraordinary. Presently, however, as if awakening from a trance, it submerged the whole of its bill to puddle, just as I had dropped another worm from above, and, when the worm squirmed in the water, the platypus leisurely opened its beak and took it in, but whether the worm accidentally slipped down the creature's throat or whether it had been deliberately devoured I cannot say.

Anyway, this convinced me that there was still a chance left of saving the platypus if I got to work at once on some temporary contrivance suitable for its immediate requirements. This I did by placing a hot-water bag beneath a dry straw bedding, in an old gin case with a feed-tin affixed con-



veniently to one end. Knowing well that a platypus would rather die of starvation than take food away from water, I placed about a half pound weight of assorted foodstuffs in the receptacle and then filled it to the brim with water. After placing the patient on the cased bedding and nailing the lid down, I discovered that a two-inch strip, at one side of the lid, was badly fractured for its full length. However, as the case and its contents were to be kept in a locked-up kitchen for the night, I, with full confidence, placed three bricks (30 lb. weight) along the fracture, guessing that this would be ample weight to withstand the strength of a poorly conditioned platypus. When I arrived next morning I discovered that I was altogether wrong in my guess, for not only had the creature made good its escape, but it did so without displacing the bricks and strip of lid from the position in which I had placed them the night before. So much, then, for the escapee's ability to readily regain strength and stamina after a term of extreme weakness. Perhaps I should explain how this apparently uncanny act was accomplished by this supposedly dull-witted creature. Between the side-board of the case (at the top) and the edge of the fractured lid, there was an opening of about a quarter of an inch, which could be reached comfortably by the animal standing up on its tail and feet, upon the bedding. This it apparently did, and then, by thrusting its beak and hands through the opening, prized the board up gradually with its wedge-shaped head until it was sufficiently high for the insertion of the powerful neck and shoulders. Meanwhile, the bricks, though raised, would not have been shifted out of their original position. Once the shoulders took the weight (a simple matter) all else would be comparatively easy, for by holding on until the hind feet assisted at the enlarged aperture, the rest would prove a simple task for this amazing contortionist. A hump of the back and it would free itself sufficiently to let the weight down gradually on to the base of its tapering tail, which would then be withdrawn like a wedge, thus allowing the board with the bricks to drop back to their normal position. This evidently is what happened, for when I removed the lid, stains and scratches marked the trail of the patient's departure from the ward. Gone, also, was every particle of the food, which with the hot-water bag was entirely responsible for the complete reviving of a dying monotreme.

In conclusion, let me say this:—As these notes are confined to Monotremes, embracing the only living egg-laying mammals known, probably I can make that tie of relationship a little more binding by asserting here, that if there is anything novel about the transformation of the claws of the platypus (*Ornithorhynchus anatinus*), then certainly the same thing applies to the echidna (*Tachyglossus aculeatus*), if not to a greater degree. And apart from that fact, I firmly believe that the growth of Echidna (when young) like *Ornithorhynchus* is just as rapid, and, moreover, that sleep of a lethargic nature is essential to both, up to the age of three months at least. Whether I am correct or not in my description of the actual growth of Monotreme nails, the fact remains that they grow, and abnormally so in the case of Echidna; therefore it would interest me to know if any authentic comparison has been made with the nails of Monotremes, reptiles, and birds.

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## ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES.

### *The Society's First Patron.*

Although under the Articles of Association the Council has always had the power of appointing patrons and vice-patrons of the Society who need not be members thereof, no such appointment has hitherto been made. The Council was waiting for a suitable opportunity, and a wholly desirable appointee. In His Excellency Air Vice-Marshal Sir Philip Woolcott Game, G.B.E., K.C.B., D.S.O., the State Governor, the Council has found the object of its desire, and His Excellency has been pleased to accept the appointment. Sir Philip is a keen nature lover, and recently spent some days at National Park with the Boy Scouts, camping part of the time at the ornithologists' cabin and the cottage at Gundamalan, which the Park Trustees have placed at the disposal of members of the Society. On plate xxxii. will be found a group picture of our patron seated on the cabin verandah, discussing bird subjects with Mr. A. H. Chisholm.

### *Election of Fellows.*

Rules governing the election of Fellows of the Society, under amended Article of Association No. 17a, have been framed, as follows:—

1. Nominations of ordinary or associate members for the title of "Fellow" must be made on a form provided for the purpose, signed by the nominator and seconded by another person, both of whom must be members of the Society. A statement of the services to Australian Zoology relied upon as qualifying the nominee for the title must be added.

2. A Qualifications Committee shall be appointed by the Council, and shall consist of the President and Honorary Secretary, *ex officio*, together with two other members of the Council, who may co-opt the Professor of Zoology of the University of Sydney, or such other zoologist, not being a member of the Council, as they may think fit.

3. Each nomination must be addressed to the Honorary Secretary, by whom it shall be referred to the Qualifications Committee for examination and report.

4. The report of the Qualifications Committee shall be submitted to the Council at an ordinary meeting, and the nominations shall then be dealt with.

The first election under these Rules took place on 28th January, the Council selecting six members upon whom the title was duly conferred. These were:—

Herbert James Carter, B.A., F.E.S.  
 Walter Wilson Froggatt.  
 Arthur Francis Basset Hull, C.F.A.O.U.  
 Tom Iredale.  
 Theodore Cleveland Roughley.  
 Robin John Tillyard, M.A., D.Sc., F.R.S.

### *New Members.*

The following new members have been elected since the publication of the last list (August 20, 1930):—

Associate Benefactor.—Dr. Gustavus Athol Waterhouse.

Ordinary Members.—Thomas Butler,\* Walter Percy Bradley, Grantley A. Duncan, Alan Fleming, K. A. Hindwood,\* A. W. M. Mowle, and W. H. Turner.\* (\*Previously associate member).

Honorary Associate Member.—Ernest Mawle (Tasmania).

Associate Members.—R. Blackwood, Noel Burnet,† M. Ferry, Matthew Edward Gray, J. Darvall Hunt, Mrs. C. A. Messmer, Harold S. Mort,† Norman M. Smith,† Miss Vera Irwin Smith,† Dr. K. K. Spence, and C. V. Thomson. († Previously ordinary member).

*New Member of Council.*

Dr. E. A. D'Ombraïn has resigned from the Council, and Mr. K. A. Hindwood has been elected to fill the vacancy. Mr. Hindwood has acted for some time as Honorary Secretary of the Ornithologists' Field Club, and is a keen bird observer and photographer.

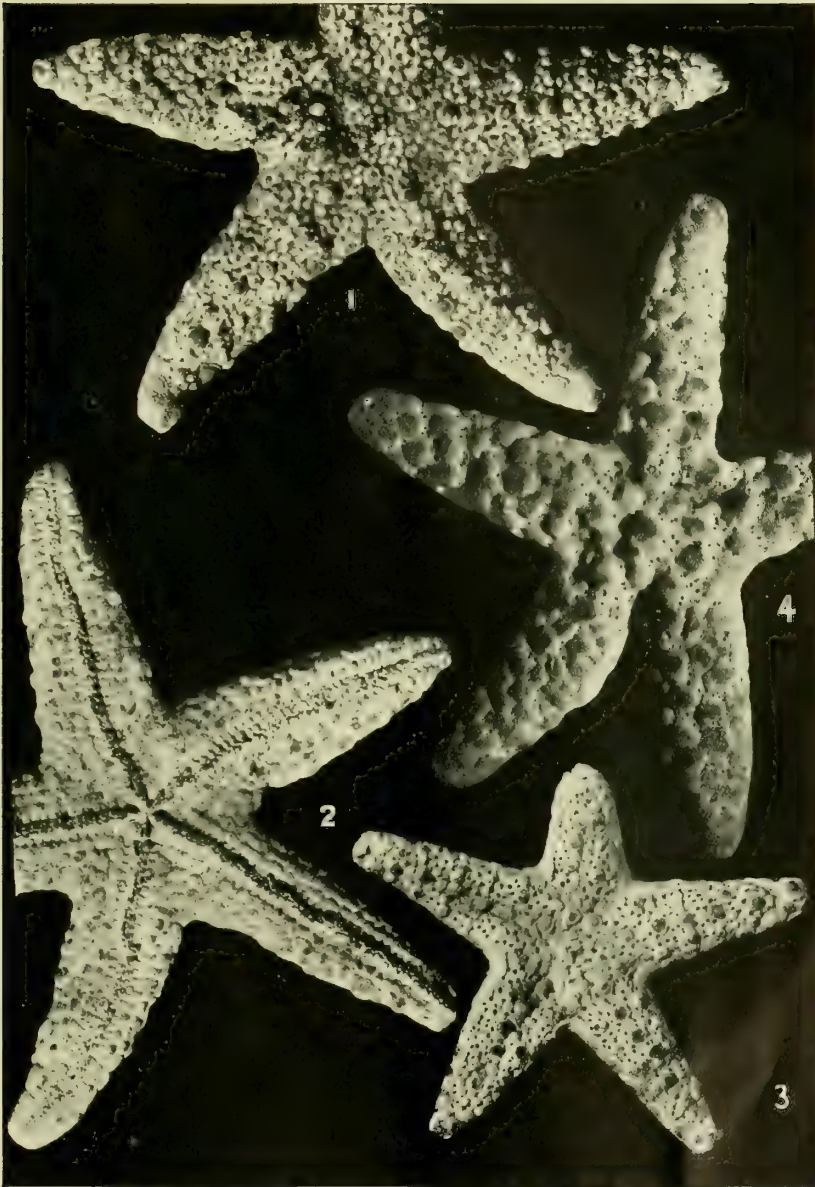
*Extension of Lease of Office.*

Arrangements have been made to renew the lease of the Society's Office, in Bull's Chambers, for a further term of three years.

## WONGA PIGEONS BREEDING IN CAPTIVITY.

(Plate xxxii., fig. 1.)

Mr. A. C. Noseworthy, of Brighton-le-Sands, near Sydney, has successfully bred Wonga Pigeons (*Leucosarcia pictata* Latham) in captivity. His account is as follows:—"The fernhouse in which the birds built their nest is as near to nature as I can get it, and is not really an aviary in the ordinary sense of the term. The spot chosen by the birds for their nest is quite open and not hidden in any way. It is really the overhang of a waterfall, and although the water runs all round the nest it does not disturb the birds. The nest is constructed of small Eucalyptus and Camphor Laurel twigs, varying in thickness. The floor of the fernhouse is covered with dry leaves, sticks and grass, and the nesting material used was picked up from this floor covering. When first starting to build both birds carry sticks to the chosen spot; the female settles herself in place and the male, standing on the female's back, finishes the nest, weaving sticks round her until they assume the required shape. From the day the first egg is laid the nest is never left unoccupied by one or other of the birds until the young ones are able to fly, when the nest is deserted by all. The young birds do not return to the nest; they roost together for a few nights, and then separate. From the day they can fly they can also feed themselves. The parent birds sit for twenty-one days, taking turns in the incubation, the male sitting in the daytime. They cannot be driven off the nest, and are very spiteful if an attempt is made to disturb them. As soon as the young are hatched out the parents carry the empty shells as far as possible from the nest. The egg-shell appears to have a hole drilled by the adult bird, and also shows markings on the interior where the young bird had been picking from the inside. For the first few days after hatching the young the parent birds sit side by side in the daytime, as though the female did not like to leave them to the sole care of the male.

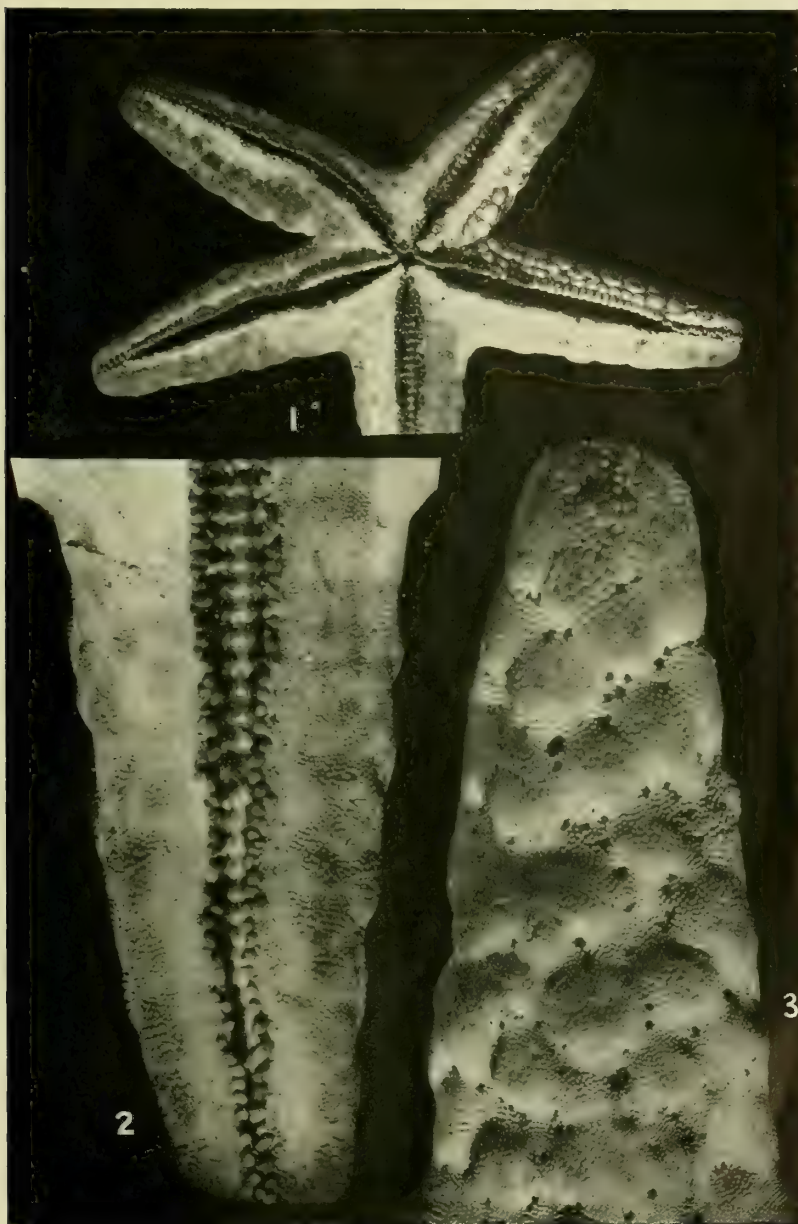


Figs. 1-3. *Neoferdina cumingii* (Gray). Fig. 4. *Ferdina flavescens* (Gray).

Photographs from the British Museum.



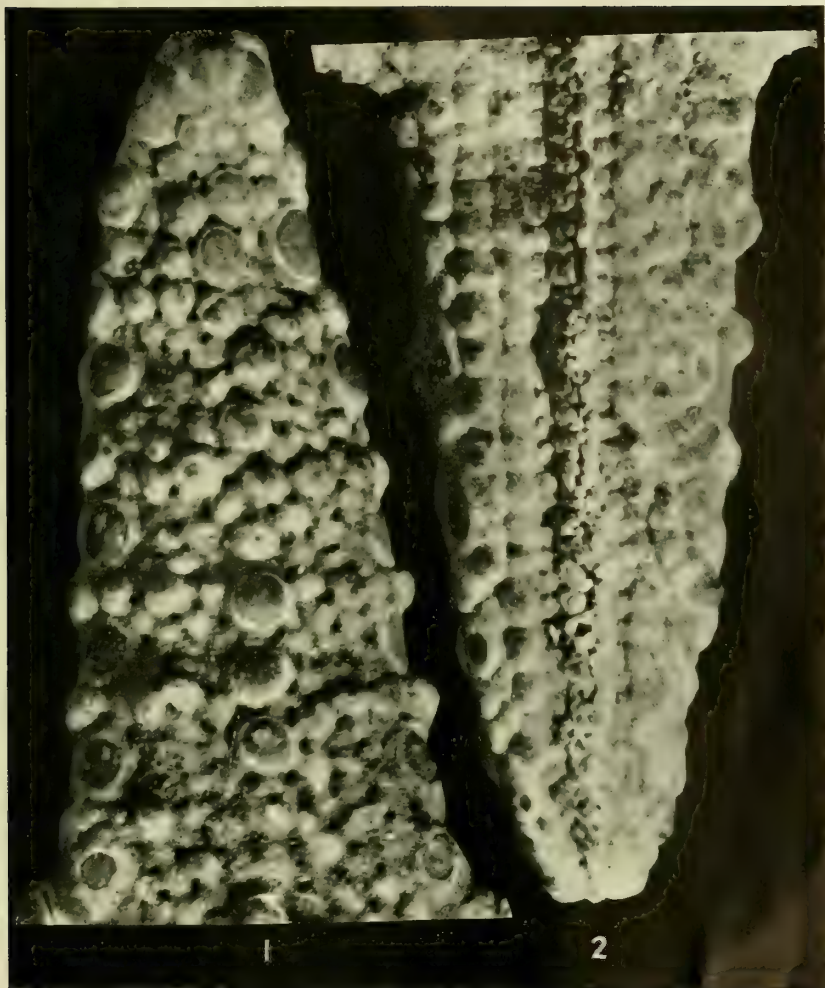




*Ferdina flavescens* Gray.

Photographs from the British Museum.



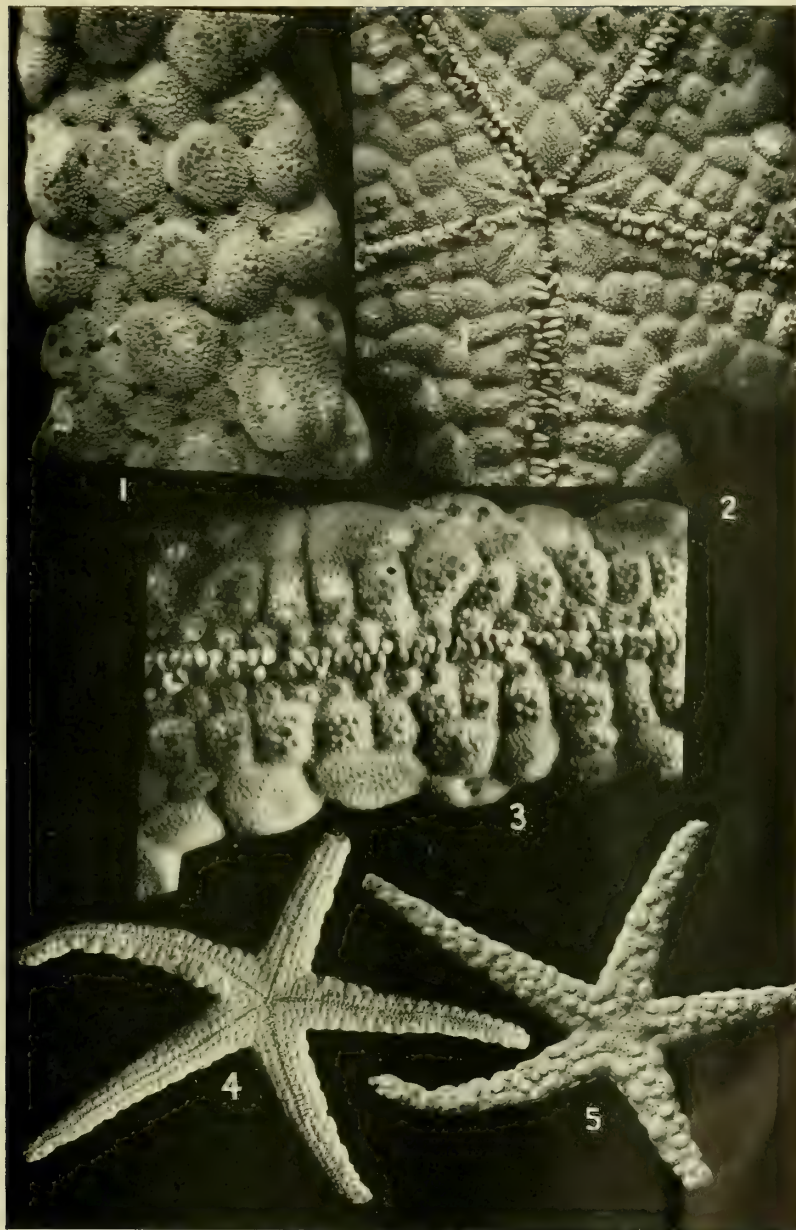


*Neoferdina cumingii* (Gray).

Photographs from the British Museum.



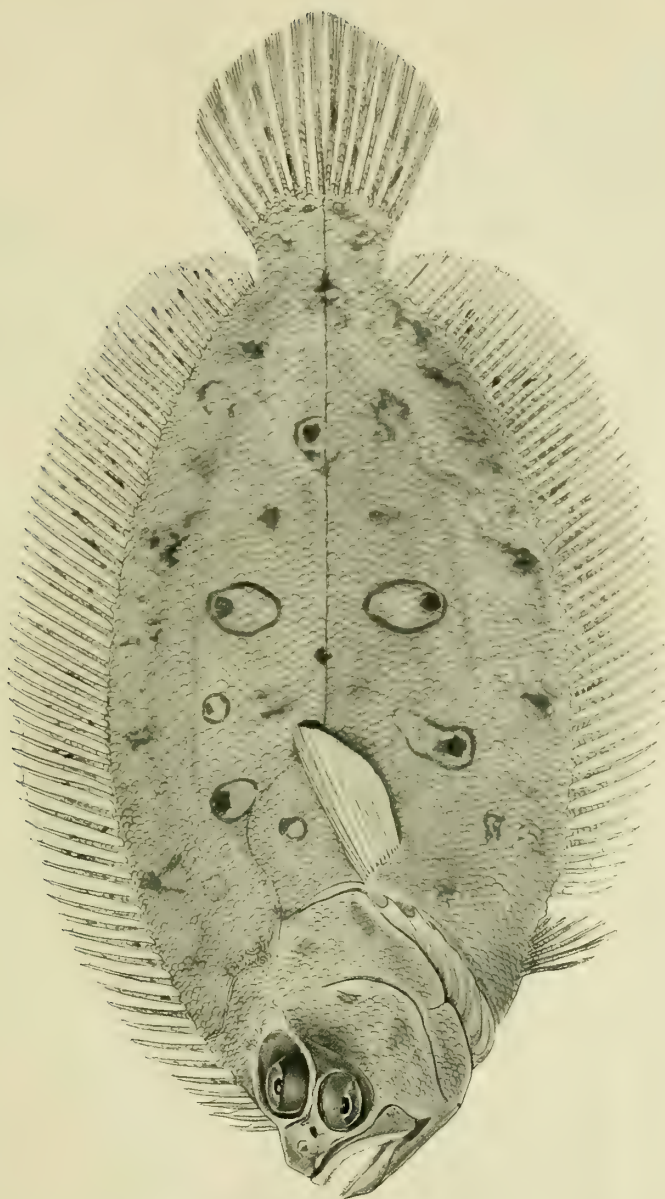




*Ferdina heffernanii* Livingstone.

Photographs by G. C. Clutton,  
Australian Museum.



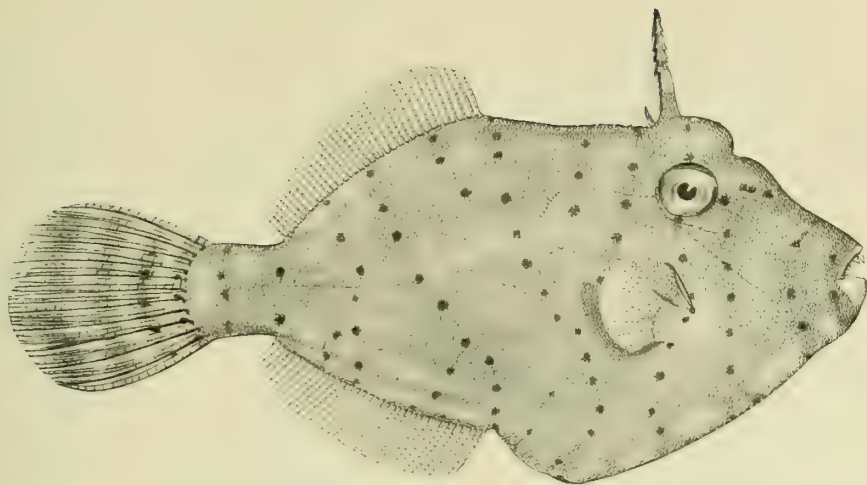


*Pseudorhombus anomalus* Ogilby.

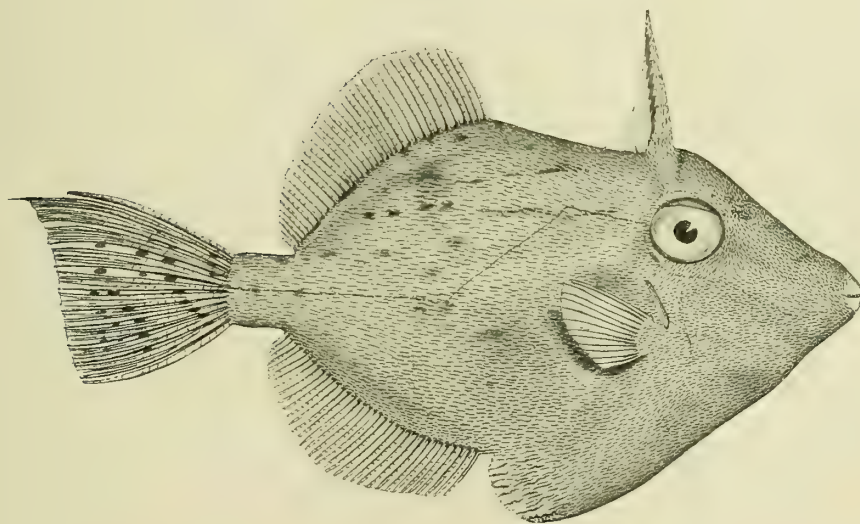
Gilbert P. Whitley, del.







1

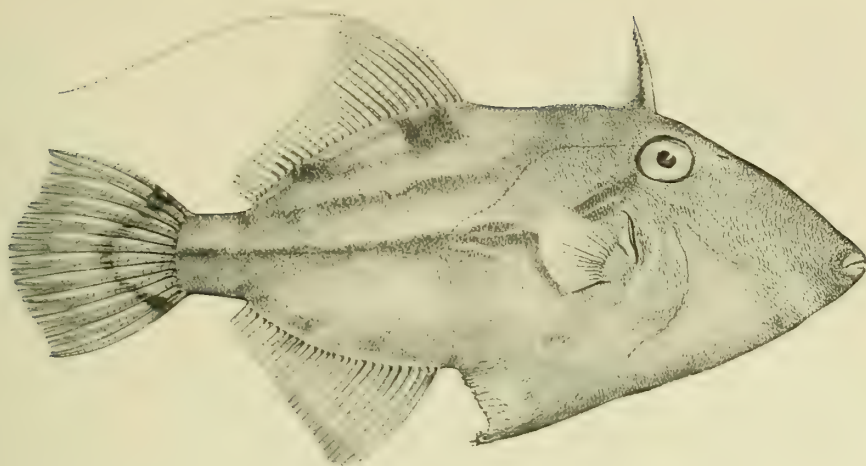


2

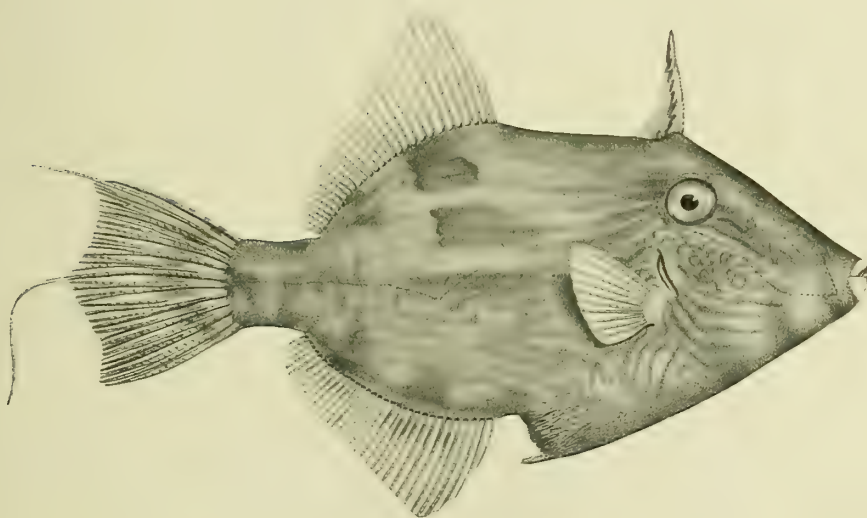
1. *Blandowskius bucephalus* Whitley.
2. *Monacanthus filicauda* Günther.

Frank A. McNeill, del.





1



2

1. *Paramonacanthus oblongus* (Temminck & Schlegel).

2. *Paramonacanthus oblongus otisensis* Whitley.

Frank A. McNeill, del.



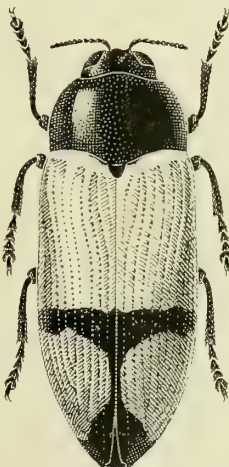
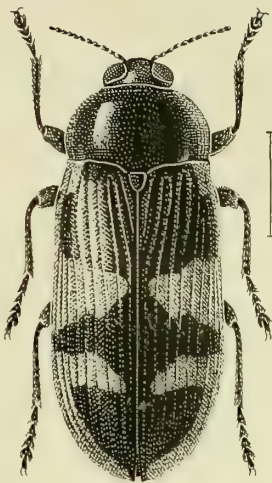
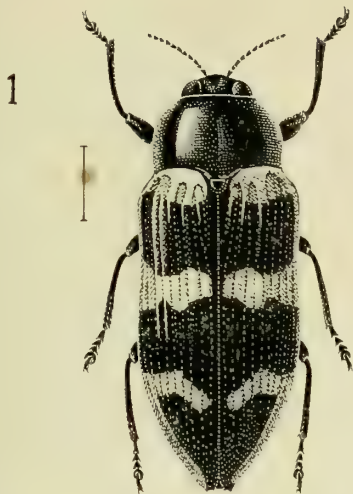




Satin Bower Bird destroying another bird's bower.

Photograph by A. J. Marshall.

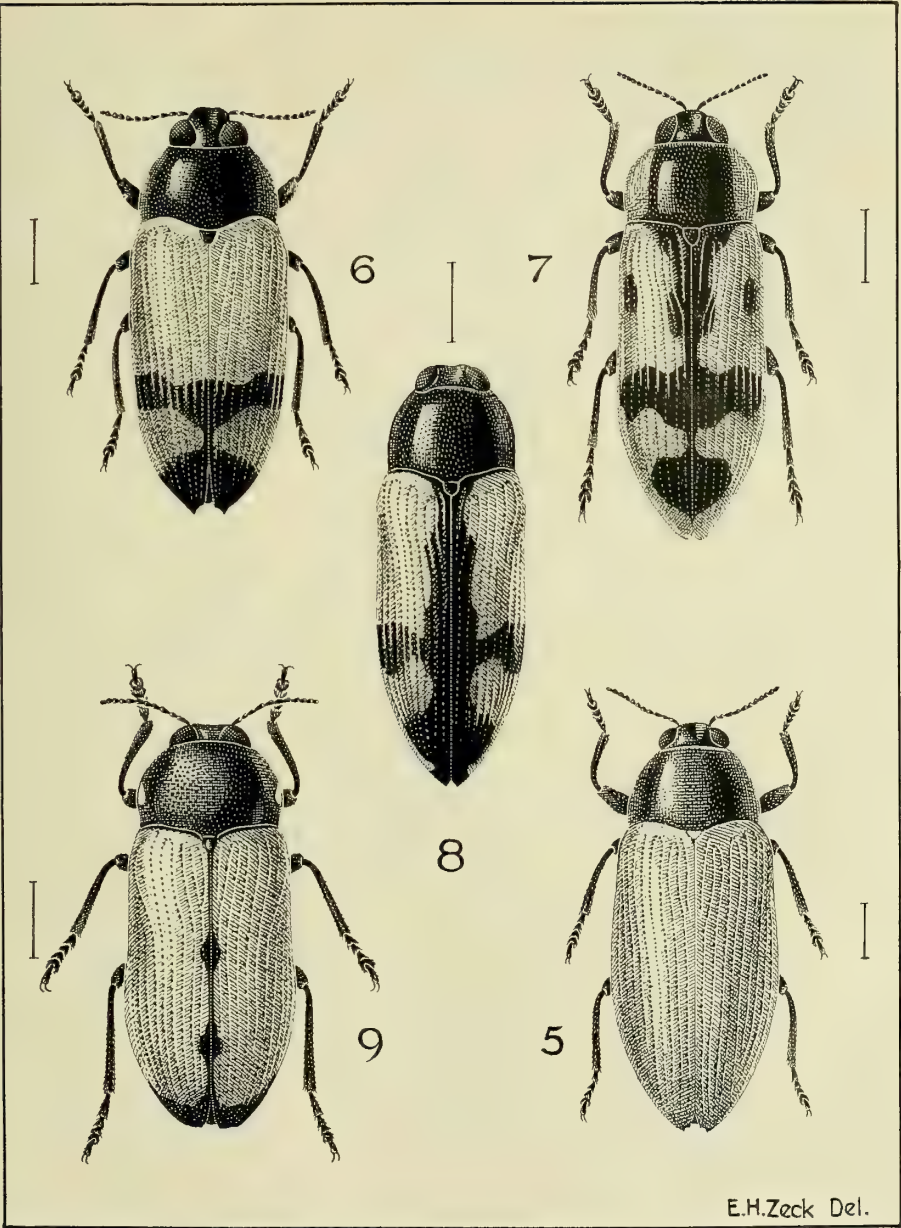




E.H.Zeck Del.

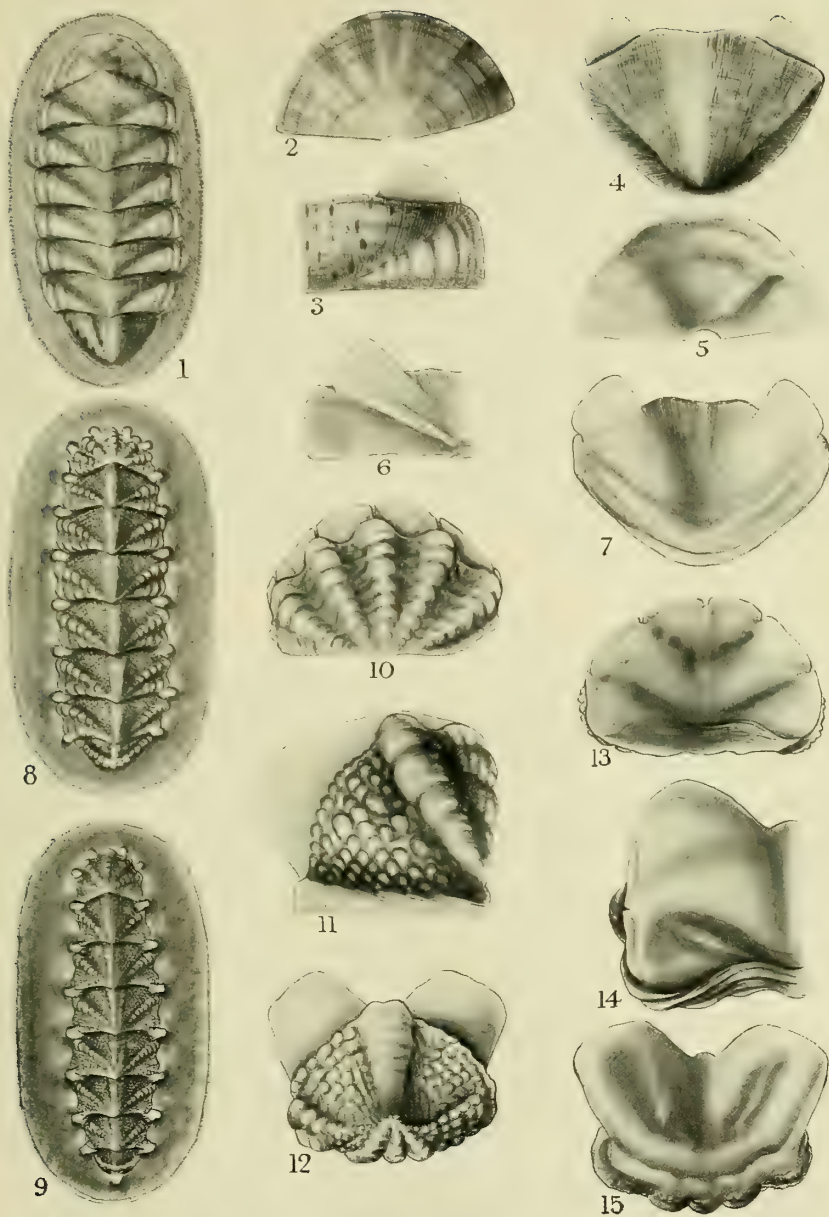






NEW SPECIES OF STIGMODERA (CASTIARINA).





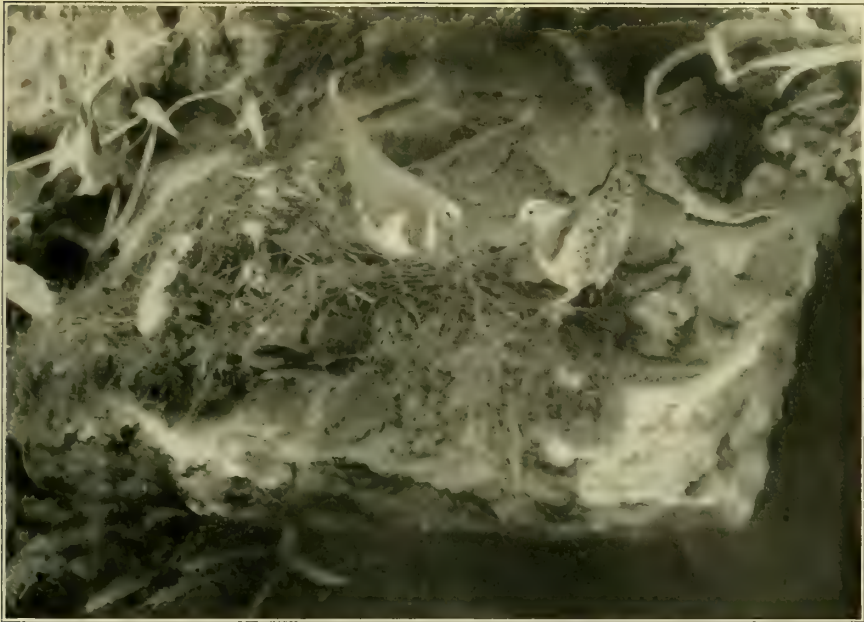
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Figs. 8-15. *Loboplax tridacna* (Rochebrune).

Joyce K. Allan, del.







I. WONGA PIGEONS NESTING IN CAPTIVITY.

Photograph by E. C. Noseworthy.



II. THE SOCIETY'S PATRON AT THE ORNITHOLOGISTS' CABIN, NATIONAL PARK.

Photograph by "Sydney Mail."



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